THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXVII., No. 9. Whole No. 1,681. | NEW YORK, MONDAY, AUGUST 26, 1907. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. THOMAS J. CUNNINGHAM, ELBERT P. CALLENDER, } Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Second Annual Meeting, American Gas Institute..... 353

EDITORIALS—
Briefly Told 353
Memorial Note, Mr. William G. Barrett—Memorial Note, Mr. Homer Parmelee.
*Devices for Cleaning Out Pipes and Tubes, by "Engineer"..... 354
The Phenomenon of Flame..... 355
*Method for the Estimation of Metallic Iron in the Presence of Its Oxides, by Mr. H. G. Martin..... 356
*The Wise Gas Hot Water Heater..... 357
Absolute Failure of the New York Destructor Plant for Public Lighting Use 358
Oil Conditions in California..... 358
*Brooke's Regenerative Gas Retort Furnace..... 359
*Photometry of Different Colored Lights..... 360
Test of a Gas Producer Electrical Plant, by Mr. L. J. Corbett..... 362
Isolated Electric Plants, by Mr. W. H. Stuart 362
Direct Current from Alternating Current: The Mercury Rectifier. 363
Electric Lighting in Germany 364
Business Methods in the American Gas Industry. 364
Recent Patent Issues..... 365
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 366
Betterments to the U. G. I. Philadelphia Works—The Pueblo Company's "Housewarming"—Dividend shared by the Milwaukee Company's Employees—A Kansas Daniel's Judgment—Mr. Miller is Hard at Work—Plant Extensions, Bridgeport, Conn.—The Mueller Co.'s Golden Anniversary—The Messrs Ridgley Did Well—Betterments at Quincy, Ills.—A San Antonio Real Estate Example—Hark! The Expert Silence—How They Do It in Pekin—Holyoke's Gas Trade is Booming—Alice Strawway's Admonition—Good Luck to Mr Palmer—And Many Other Items.
The Market for Gas Securities..... 368

Secretary Dunbar telegraphs us that the New Willard Hotel has been chosen as headquarters.

[OFFICIAL NOTICE.]

Second Annual Meeting, American Gas Institute.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Aug. 19, 1907.

To the Members, American Gas Institute: The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18, and will be called to order by the President, Walton Clark, of Philadelphia. Institute headquarters will be announced in a later edition.

The named papers have been secured by the President for presentation to the Institute, together with the reports of the following committees:

"Depreciation;" by Mr. A. C. Humphreys.

Communication from New England Association; by Its Committee on Uniform Accounting and Depreciation.

Report of Committee on Methods of Taking Candle Power; by Mr. Wm. H. Gartley, Chairman, Philadelphia, Pa.

Experience in Omaha on "Delivering Uniform Candle Power to Consumers;" by Mr. George H. Waring.

"The Obligations Imposed by the Possession of a Franchise;" by Mr. Chas. H. Dickey.

Report of Public Policy Committee; Mr. E. G. Cowdery, Chairman.

Report of Committee on Making of Rates and Additional System of Costs; Mr. W. H. Gardiner, Chairman.

Report of Committee on Economic Balance between Calorific Value and Candle Power; Mr. Thos. D. Miller, Chairman.

Report of Committee on Board of Revision; Mr. W. H. Shattuck, Chairman.

"Instructions for Operating Recuperative Benches;" by Mr. W. A. Baehr.

"Experiments in Carbonization;" by Mr. W. H. Fulweiler.

Lecture on "Electrolysis;" by Prof. A. F. Ganz.

Report of Committee on Electrolysis; Mr. A. G. Glasgow, Chairman.

Report of Committee on Pipe Standards; Mr. Walton Forstall, Chairman.

Experience with Dipping Meters; reports from Baltimore, by Mr. A. S. Miller. Also reports from Philadelphia and Savannah.

Report on "A" Meter Results from Philadelphia and Kansas City.

Report of Committee on Uniformity of Meters; Mr. Charles H. Dickey, Chairman.

The Passenger Associations will not consider rates on the certificate plan until after their next meeting, which convenes September 10th. Many State Legislatures having enacted the 2-cent rate, the Commissioner of the Trunk Line Association writes as follows:

143 LIBERTY ST., N. Y., July 25th, 1907.

MR. JAS. W. DUNBAR, Sec. American Gas Institute, New Albany, Ind.:

Dear Sir—Referring to your letter of the 15th, beg to advise that, on account of the unsettled rate conditions, the Trunk Lines feel they cannot consider the question of reduced fares for meetings or conventions to be held after the month of September, until their next meeting, which will convene on September 10th, after which we will promptly communicate to you decision reached respecting your application.

Yours truly,
(Signed) L. P. BARNES, Commissioner.

The Secretary will be pleased to mail applications to those who may wish to become members of the Institute. Further detailed information in reference to the convention will be forthcoming.

Yours truly, JAMES W. DUNBAR, Secretary.

BRIEFLY TOLD.

MEMORIAL NOTE—MR. WILLIAM G. BARRETT.—The gas fraternity lost one of its oldest and best beloved members in the death of Mr. William G. Barrett, of Oakland, Cal., who for nearly 50 years has been identified with the lighting interests of San Francisco. Mr. Barrett was born in Chester, Vt., December 12th, 1822, and crossed the plains in 1850 to the Placerville region in California. In 1860 he became Collector, and in 1862 Cashier and General Bookkeeper of the San Francisco Gas Light Company, and in 1877 he was elected its Secretary and Treasurer, holding this dual position through the various mergings and successive ownerships of the San Francisco lighting interests, until 1902, when he was retired as Secretary *emeritus* of the San Francisco Gas and Electric Company. Mr. Barrett was one of the early members of the old Union Club, and afterwards of the Pacific Union, as well as of the Bohemian, Clubs of San Francisco. When the Pacific Coast Gas Association was formed, July 11th, 1893, the deceased signed on the roll of Charter Members as number four, and on July 16th, 1902, he was unanimously elected an Honorary Member of the Pacific Coast Gas Association. During these years, he was a constant attendant upon the meetings of

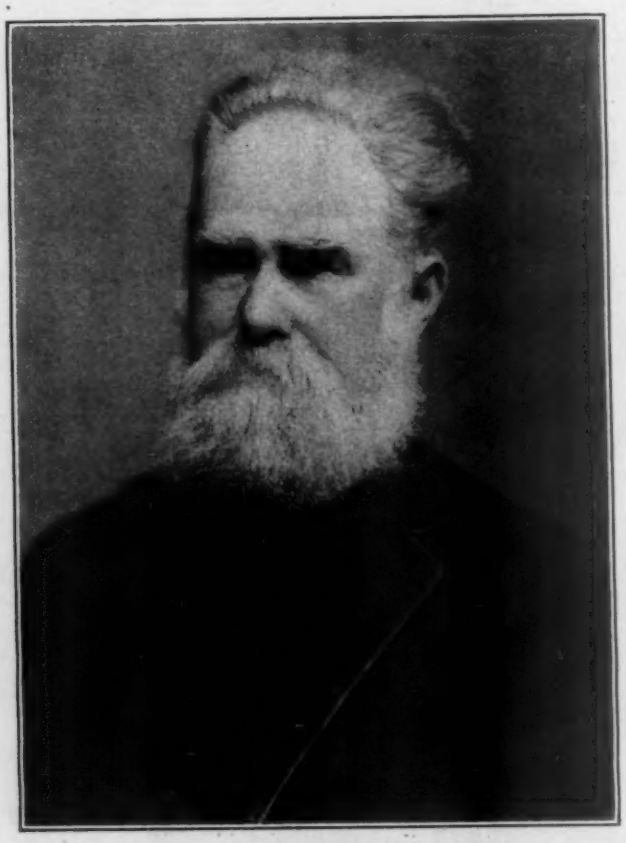
LIBRARY OF CONGRESS, AUG 26 19 SMITHSONIAN DEPOSIT.

Association, and although not an active participant in the discussions, his genial and kindly presence, as well as the love which we all bore him, brought sunshine into our meetings. Mr. Barrett died at his home in Oakland, on the morning of Thursday, August 8th, 1907, after a brief illness. Besides his widow, he leaves a son, Charles L. Barrett, who succeeded to his father's position in the San Francisco Gas and Electric Company, and a daughter, Mrs. Stetson G. Hindes. The Pacific Coast Gas Association was represented among the pall bearers at the funeral, which occurred Sunday, August 11th, at Oakland, Cal., and a floral tribute in the form of the badge of the Association was its contribution to his bier. Floral pieces were also sent by employees of the San Francisco Gas and Electric Company, all of whom looked upon Mr. Barrett as a dear friend and counsellor.

"His youth was innocent; his riper age
Marked with some act of goodness every day;
And, watched by eyes that loved him, calm and sage,
Faded his late declining years away.
Meekly he gave his being up, and went
To share the holy rest that waits a life well spent."

[For this memorial no e we are indebted to the fraternal attention of Mr. Edward C. Jones, Chief Engineer, Gas Department of the San Francisco Gas and Electric Company.]

MEMORIAL NOTE, MR. HOMER PARMELEE.—"Mr. Homer Parmelee passed away at the home of his brother, Mr. Justin Parmelee, 1056 West Monroe street, Chicago, on Monday, August 12, in his 89th year. The funeral was held from his brother's residence the following Wednesday, interment being made at Forest Home. Deceased, who was



born at Middlebury, Vt., December 31, 1818, was of the Mayflower stock, and was the oldest of 12 children of Mr. Howell Parmelee, of West Troy, N. Y., the inventor of the first successful coal or wood cook stove, which was known in those early days as the "Parmelee Diamond Cook." Homer Parmelee who was a pattern maker by trade, was employed for years by Messrs. Bartlett, Hayward & Co. On account of his great power of invention, very many practical machines in use in the boiler shops of to-day are due to his genius. In his eightieth year the necessity of a pipe wrench, that would neither chew the pipe nor mar the threads, brought from his still fertile mind a device very much like the hand itself, which fortunately he patented himself as the "Parmelee Wrench," and he successfully marketed it in Philadelphia. After 5 years' enjoyment of the fruits of his latest invention he failed in health and came to Chicago to live with his youngest brother, Justin, to whom he transferred the burden of his business affairs, slowly declining until the end.—* * *"

[Prepared for the JOURNAL.]

Devices for Cleaning Out Pipes and Tubes.

By "ENGINEER."

As the gas man always needs a number of different styles of pipe and tube cleaning devices, some of the various patterns are shown in the illustrations. The pipe and tube cleaning contrivances of the present day may be classed under four heads. First, the crude descriptions of shop-made or home-made devices, consisting of rods, rammers, fiber-headed rods, mop-heads, wire balls, etc., which are used in an imperfect manner as a rule for removing debris from the interior work of tubes and pipes. Then there are the more advanced types of devices, constructed in line with cylindrical formation, with spirals or lips attached, which are forced into the pipes or tubes and caused to cut into and remove the scale or other material which may be there. The third class of cleansing devices of this order includes the types of revolving blades or disks which are turned by hand for the purpose of cutting into the foreign matter in the tubes. The fourth and last class includes the turning disks which are propelled by water or steam power.

Referring back to the first class of pipe and tube cleaning devices, Fig. 1 illustrates the crudest description in use. It consists of the plain, hardwood rod—a stick of bamboo is suitable for the purpose. The strong, elastic qualities of the wood make it possible to push the rod forward and backward in the cavities and clean them out.

Fig. 2 shows one of the same class, but of uneven surface, and in Fig. 3 is shown one of the fiber-headed rods, consisting of a strong, hardwood stem, to the tip of which is wound the cords; Fig. 4 is virtually one of the same class, but having a heavier winding. The object of the head is to give a means for rubbing and scraping the interior surfaces of the pipes or tubes. Another form of hand device for this service is outlined in Fig. 5, which is made by binding some pieces of cloth to the terminus of a rod; a regular mop-head is made. This is for the larger sized cavities. The head is dipped in lye or other cleansing liquid and is pushed to-and-fro within the walls of the piping, cleaning the same of objectionable and clogging matter. Then there is the oval wire cage style of cleaner, as in Fig. 6. The terminus is constructed like a cage, by winding up the lines of wire as shown, hence the wire ball-head can be pushed into the pipe opening and the mass of matter loosened by the strands of wires. An arrow head style of rod is shown in Fig. 7. This type of head comes into play to advantage when some hard substances are in the pipe with which to contend. The hard, sharp point can be pushed into the substance and the latter broken up for a more easy removal.

Passing from this class of pipe and tube cleaning device, we go to the better and more effective styles. A common form of worm cylinder cleaner is exhibited in Fig. 8. This is made by using a plain metal cylinder, somewhat smaller in diameter than the system of piping in which it was intended to be used, then a coil of wire about $\frac{1}{8}$ inch in diameter was wound spirally about the cylinder, as shown.

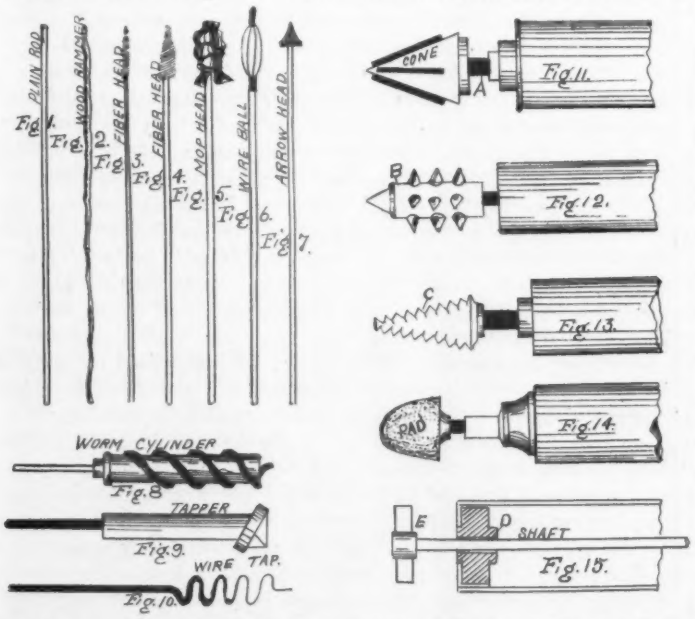
Soldering of the wire to place made the job secure, so that in order to make the wire worm effective on the stuff within the tube, it was necessary only to revolve the same. The agency for revolving the cylinder head is a hand-crank fixed with a set-screw to the end of the shaft at the outlet of the pipe. As all of the rods for carrying the operating heads are flexible in character, it is possible to get around certain angles; of course the sharp bends cannot be made. In this case, the cleaning out is effected by working from either end towards the sharp bend.

The form of tapper shown in Fig. 9 is employed for breaking up solid matter which may be in the hollow of the tubes. It is, in fact, a type of butting ram. The operation involves the drawing back of the head by means of the rod which carries it, following this motion up by driving home the affair against the interior clogging. In a little time the pummelling serves to break up the clogged stuff, making it possible to withdraw the same with some of the extracting devices before mentioned,

Sometimes it is only necessary to reach within the pipe to withdraw some clogging agent which has accidentally lodged. In Fig. 10 is shown one of the wire taps most convenient for this service. It consists of a rod which is bent up at the end for the worm form. The end of the metal terminates in a fine point, and as the winding produces a screw formation, it is possible to turn the shaft and make the tip of the screw impregnate the clogging substance. Then, as soon as a grip is obtained, the affair is pulled out, drawing the clogging substance with it. Pieces of clothes, wood and other articles often get lodged in the pipes. They can be pulled out in many instances

with the wire screw tap. Then there are the more mechanical devices for this work which are coming into more frequent use, and some of these affairs are operated entirely by hand power. The custom is to extend the shaft carrying the wheel or cone through bearings supported in a pipe, which pipe is small enough in diameter to permit of its being passed into the tube. Hence pipes of various diameters are used. There are adjustable cones and body-wheels, so as to get the different sizes for different descriptions of pipes. The shaft which passes through the pipe, marked (*A*), Fig. 11, is furnished with its crank at the end; or, in case that the affair is to be operated by mechanical means, the necessary combination of fan wheels and propellers is fitted in for receiving the charges of steam, water or compressed air for doing the revolving. Of course the latter systems of propelling the cutting and cleaning heads are far in advance of the hand-crank mode. In Fig. 12 the head is shown with the points of steel set into bores in the headpiece, as at (*B*). Some users of tube cleaning devices prefer the pointed heads to the winged or lipped kind, shown in Fig. 11. In the latter the lips are made of steel, set into slots in the cone-head.

Fig. 13 is a corrugated head which one sees occasionally. The saw-like teeth (*C*) are quite effective in cutting through compact masses of greases, sand, scale, etc., in pipes, and for that reason are often used. The pad-head, shown in Fig. 14, can be used only on soft stuff. It is often engaged to do the final cleaning after the heavy stuff is removed. Fig. 15 shows the interior formation of the bear-



ings for carrying the shafting, as at (*D*). The head (*E*) of this type of cleaner is fitted with 4 steel projections which are revolved swiftly within the pipe, causing the breaking up of the interior mass of foreign stuff which gathers in time in many systems of pipe.

The Phenomenon of Flame.

At the Leicester meeting of the British Association for the Advancement of Science, Professor A. Smithells, President of the Chemical Section, in his address made extended remarks on "The Phenomenon of Flame," which remarks were in keeping with his close knowledge of the subject. Indeed it is undoubtedly quite in line with truth to say that science is indebted to Professor Smithells, more than to any other man of his day and time, for the outcome of his researches in the realm of flame. The Professor said:

The topic of flame after a long period of repose, has aroused much interest during late years, and I think we may say that some considerable progress has been made in its elucidation, though in this, as in all other subjects of scientific inquiry, the more closely we scrutinize it the more impressed must we be with what still remains unknown.

One of the first questions to meet us in the study of flame is that of the temperature at which, in any given case, the phenomenon becomes evident. Here, I think, a great clarification of view has taken place. The old idea that there existed a fixed temperature at which inflammation suddenly took place cannot now be maintained, and the term "ignition temperature" has acquired a different meaning. It is now known that in a very great number of cases a mixture of two flame-forming gases, when gradually raised in temperature, will develop luminosity quite gradually *pari passu* with the chemical combination that is being induced. This phenomenon is, of course, known universally, in connection with phosphorus; but it is not so widely known in connection with other combustible substances. I do not know how many times the independent discovery has been made that sulphur, arsenic, carbon disulphide, alcohol, ether, paraffine and a whole host of other compounds, inorganic and organic, will phosphoresce as truly as phosphorus itself—that, in fact, phosphorescent combustion is the normal phenomenon antecedent to what we ordinarily call flame.

This is, after all, only in harmony with the general truth that chemical combination between two gases does not set in suddenly, but comes into evidence quite gradually as the temperature is raised from a point at which the action, if it occurs at all, is so slow as to be negligible. The change from phosphorescence to ordinary flame is not sudden, but the appearance of ordinary flame is the end point of a continuous, though rapid, development. This end point is the temperature of ignition. What, then, determines the temperature of ignition? The answer to this question has been given with characteristic conciseness by Van 't Hoff as "the temperature at which the initial loss of heat due to conduction, etc., is equal to the heat evolved in the same time by the chemical reaction."

Temperature of ignition is, then, neither a temperature at which combination suddenly begins, nor one dependent solely on the nature of the combining gases. It will vary with the proportion in which the gases are mixed and with their pressure and other circumstances. Notwithstanding the simplicity of this conception, it must be admitted that there are many obscure facts connected with the ignition of gases. The inflammability of gaseous mixtures is not necessarily greatest when they are mixed in the proportions theoretically required for complete combination. The influence of foreign gases does not appear to follow any simple law; the presence of a very small quantity of a foreign gas may exercise a profound influence on the ignition temperature, as in the case of the addition of ethylene to hydrogen. When a mixture of methane and air is raised to its ignition temperature, a sensible interval (about 10 seconds) elapses before inflammation occurs. These facts are cognate to others which have increased upon us so abundantly in connection with the influence of moisture on chemical change.

The structure of flames has always been regarded as dependent upon the chemical changes taking place in the differentiated regions; but until recent times little attention has been given to any question beyond the cause of the bright luminosity of hydrocarbon flames. In a flame such as that of hydrogen or carbon monoxide, where we have some reason to suppose that the same kind of chemical transaction is taking place throughout the region of combustion, we should not expect to find a differentiation of structure; and, as a matter of fact, we do not find any. Erroneous ideas have gained currency from the use of impure gases; and hydrogen is still described as burning with a pale blue flame, although Stas long ago stated that if the gas is highly purified, and the air freed from dust, the flame, even in a dark room, can only be discovered by feeling for it—a fact consistent with the line spectrum of water lying wholly in the ultra violet. The presence of a very small quantity of free oxygen in carbon monoxide destroys the perfect simplicity of the single shell of blue flame with which the purified gas burns; and in other flames small quantities of gaseous impurities or of atmospheric dust give rise to features of structure and halos which have been frequently supposed to pertain to the flame of the combining gases. The fringe of a flame in air may be often tinged by the presence of oxides of nitrogen.

No flame better illustrates the relation of structure to chemical processes than that of cyanogen, where the two steps in the oxidation of the carbon are clearly marked out in color. Apart from hydrocarbon flames, very few others have been carefully explored from this point of view. There is, unfortunately, no gas composed of two combustible gaseous elements; and, though such gases as the hydrides of phosphorus and sulphur do not fall far short of this, the experimental difficulties of an exact exploration of their flames are very great. We are thus prevented from studying the flame of a composite combustible in its simplest forms.

The flames of hydrocarbons have naturally been the subject of most frequent investigation. The use of single hydrocarbons instead of the mixtures present in coal gas and other common combustibles has simplified the study considerably. Two problems stand out prominently. One is to trace the steps in the oxidation of the hydrocarbon, the other to account for the bright patch of yellow luminosity. With

regard to the question of the luminosity, I do not think there is any longer doubt about its being due essentially to the separation within the flame of minute solid particles of what is practically carbon. The separation seems to be adequately explained by the high temperature of the blue burning walls of the flame, which decomposes the unburnt hydrocarbon within. In a similar way, arsenic and sulphur and phosphorus are liberated within flames of their hydrides; but these elements, being volatile, do not appear as solids unless a cold object be placed within the flame. In the case of the hydride of silicon, the liberated element at once oxidizes to form the solid non-volatile oxide, which gives a bright glow.

The mode in which a hydrocarbon yields carbon by the application of a high temperature has been the subject of experiment and of hypothesis. But neither the view of Berthelot, that the carbon results from a continual coalescence of hydrocarbon molecules with elimination of hydrogen, nor that of Lewes, according to which the formation and sudden decomposition of acetylene is the essence of the phenomenon, appears to me to be in harmony with the experimental facts; and I am not aware that either view has secured any support from other workers in this field. It is certainly not easy to ascertain experimentally the changes undergone by a single hydrocarbon as its temperature is raised, and at the last it may be objected that the course of events in contact with the solid walls of a containing vessel is not necessarily the same as that within the gaseous envelope of a flame. I am glad to think that there is promise of further light on this subject from the work of Professor Bone.

The course of oxidation of hydrocarbons has been the subject of very careful and fruitful study. The old view that a selective or preferential oxidation of the hydrogen always took place—that with a restricted supply of oxygen the hydrogen was oxidized and the carbon set free—is, I think, no longer maintained by anyone who has studied the question. The explosion of ethylene with its own volume of oxygen, which leaves us with practically all the carbon oxidized and all the hydrogen free, is fatal to this view. Again, when hydrocarbons are burnt in a flame with a restricted supply of air, as is the case in the inner cone of the flame of a well aerated Bunsen burner, there is clearly no separation of solid carbon, and the products of combustion, when withdrawn and analyzed, disclose the presence of much free hydrogen and no unoxidized carbon.

The admirable researches carried out in the University of Manchester by Professor Bone and his collaborators, have afforded most valuable information as to the oxidation of hydrocarbons at temperatures extending from those of incipient oxidation up to the highest ones that prevail in a flame. According to Professor Bone, the oxidation of a hydrocarbon involves nothing in the nature of a selective or preferential oxidation of the carbon or the hydrogen; for it occurs in several well defined stages, during which oxygen enters into, and is incorporated with, the hydrocarbon molecule, forming oxygenated intermediate products, among which are alcohols and aldehydes. The reaction, just referred to, between ethylene and an equal volume of oxygen is, according to Professor Bone, to be represented by the scheme:

$$\begin{array}{ccccccc} CH_2 & & CH.OH & & CH.OH & & H_2C:O \\ \vdots\vdots & \longrightarrow & \vdots\vdots & \longrightarrow & \vdots & \longrightarrow & \\ CH_2 & & CH_2 & & CH.OH & & H_2C:O \end{array} \qquad \longrightarrow \quad H_2 + CO \quad + \quad H_2 + CO$$

There can be no question about the facts on which this scheme is based, and they are a new and important addition to knowledge; but there are reasons that prevent me from accepting entirely the interpretation which he has given to his experimental results. [Professor Smithells stated his reasons.]

The mode of burning of carbon, whether in the free state or as a constituent of a compound, is not at all easy to determine; and, notwithstanding many investigations, among which must be specially mentioned those of Professor Harold B. Dixon and his collaborators, so simple looking a question as whether carbon forms carbon monoxide by directly uniting with oxygen, or only by reducing carbon dioxide, is still a matter of uncertainty. Our knowledge concerning the question of flame temperatures has been much improved in recent times, thanks mainly to the admirable work of M. Le Chatelier. The well-known memoir of Mallard and Le Chatelier on the explosion of gases supplied the data which first permitted of a moderately exact calculation of flame temperatues; and the perfection of the thermocouple by M. Le Chatelier gave us the first instrument that could be used directly for making a satisfactory measurement. The uncertainty connected with this subject may be well illustrated by quoting the temperatures that had at different times been ascribed to the flame of coal gas when consumed in a Bunsen burner, where we have had values from 1,230° to 2,350° C.

With regard to the use of thermo-couples, I may remark that the practical difficulties have been successfully met. The chief difficulty is, of course, to secure that the thermo junction attains, as nearly as possible, the temperature of the region in which it is immersed. As ordinary flames consist of thin shells of burning gases, on either side of which there is a very rapid fall of temperature, it is necessary to use thin wires, and to dispose them so that there is no appreciable drain of heat from the junction. By using wires of different gauge for the couples, it is possible by extrapolation to arrive at a temperature for a couple of infinitely small cross section, and it is also possible to make a correction for the superior radiating power of the couple as compared with the flame gases. Without this last correction, a maximum temperature of 1,770° C. was obtained for the Bunsen flame by Waggener in Germany, and 1,780° by White and Traver in America. Correcting for radiation, Berkenbusch found 1,830° as the maximum temperature. M. Féry, by an ingenious application of his beautiful optical pyrometer to a flame containing sodium, gives 1,871° as the highest temperature of the flame of a Bunsen burner burning coal gas.

The consideration of flame temperatures has become of increasing importance in the arts, owing to the use of the Welsbach mantle as a means of deriving light from coal gas. The great improvements which have been made in the efficiency of atmospheric burners depend primarily on the fact that the smaller the external surface we can give to a flame consuming gas at a fixed rate, the higher must be the average temperature; and since the emission of light from a mantle is proportional to a high power of the absolute temperature, a small increase of temperature is of great effect on luminosity. The acetylene oxygen flame, in which a temperature of about 3,500° prevails—not very different from that of the electric arc—is the hottest of the hydrocarbon flames, and finds some important practical uses.

I have already said something about the luminosity of flames so far as relates to the separation and glow of solid carbon. But there remains the more general question of the luminosity of flames containing nothing but gases. The older explanation of the emission of light from conbining gases said no more than that the energy liberated during the reaction and appearing as heat raised the product to incandescence—that is to say, so increased the velocity of its molecules and the violence of their collisions that vibrations were set up whose wave lengths lay within the limits of visible radiation. This explanation has long been questioned, and there is now, I think, a very general agreement that it will not suffice. The average temperature, in fact, prevailing in a flame, if attained in the product of combustion by the supply of heat from outside, does not suffice to make that substance luminous. We are therefore thrown back upon the conclusion that the generation of light in a flame is not a consequence, though it is an accompaniment, of the elevation of temperature.

The question now is: Can we go any farther? To do this we are led to consider individual molecular transactions instead of statistical averages; and the view presents itself that the combining atoms may, in losing their chemical energy, form directly systems of independent vibration where the radiation is such as to fall within the limits of visibility. If we picture such vibrating systems momentarily formed, it is easy to see that by their collision one with another they may acquire, in a secondary way, increased translational motion, and so lead to a state of things where the greater part of their energy is degraded in the form of heat. The high temperature of a flame would then be a consequence rather than a cause of its light. This subject of the mechanism of luminosity, however, like so many others, has now become involved with the theory of electrons, and a chemist may be excused if he hesitates to pursue the subject farther.

Method for the Estimation of Metallic Iron in the Presence of its Oxides.

By Mr. Henry G. Martin, in *Jour. Am. Chem. Soc.*

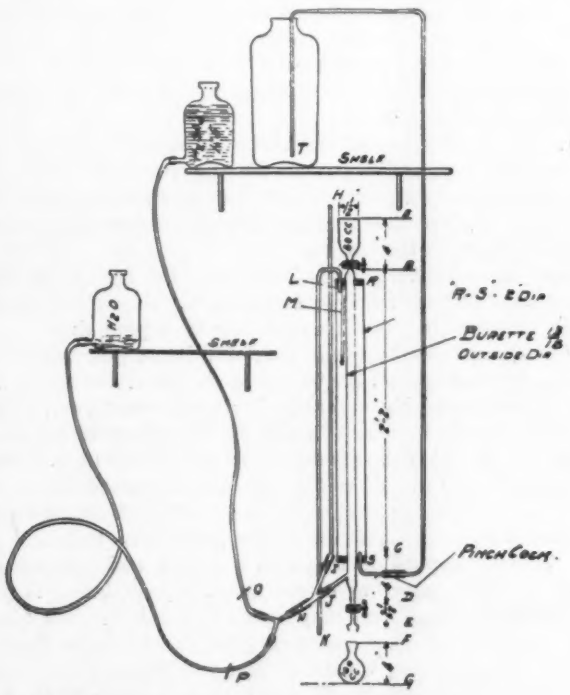
For several years the writer has used the following method for the determination of the amounts of metallic iron, ferrous oxide and ferric oxide present in furnace products. The total iron is determined by solution, fusion of the insoluble residue, and titration. The sum of the ferrous iron and the metallic iron is determined by solution in dilute hydrochloric acid, with exclusion of the air and titration of the solution. And finally the metallic iron is determined by measuring the hydrogen evolved on dissolving the substance in dilute sulphuric acid. The method cannot, of course, lay claim to strict accuracy,

since it disregards the ferrous iron of the insoluble residue and also assumes that the ferric iron present is not acted upon by the hydrogen evolved during the solution of the metallic iron. If manganese is present, other errors may by introduced, and if the manganese content is high, the results are uncertain.

The hydrogen evolved by the solution of the metallic iron is determined as follows:

The burette *A-E* is arranged according to G. Neumann and graduated in 1/5 cc. beginning at the stop-cock *B*. *R-S* is a water jacket supplied from a bottle on the upper shelf or from the hydrant. *M* is a small thermometer. *R* and *S* are secured by split wooded corks sealed with cement made of litharge and glycerol. *I*, *J*, *N*, *O* and *P* are pinch-cocks. The burette at *E* is ground into the flask *F-G*. The bottom of the flask is about 8 inches from the table top and when in position under *E* is supported by wire gauze and an iron ring. *D* is a cock of quite large bore. The burette *A-E*, together with three of the flasks, made interchangeable, were furnished by Geo. D. Feidt & Co. The remainder of the apparatus is home-made. *S-T* and *L-K* are of small bore; *H-I* should approximate the burette in bore.

Have the tube leading from the sulphuric acid bottle filled with the acid to its connection with the *Y*, then, with *J* and *O* closed, raise the water bottle until all the tubes are filled and the water has risen



APPARATUS FOR DETERMINATION OF METALLIC IRON.

LUMENS IRON & STEEL CO
9-19-06

in the level tube *H-I* to near the top; close *P*, *N* and *I*, and open *J*, and set the water bottle on the lower shelf or on the table.

Weigh from 0.2 to 10 g., or more, of the material, according to the quantity of metal supposed to be present, into the flask *F-G* and fill to the neck with water and place in position on *E*; support it properly and place an Argand burner under it with sufficient flame to boil the water, *D* and *B* both being open. Open *I* just enough to let a few cubic centimeters of water run into the burette. This will serve to completely fill the flask and tube *D-E* to above the cock *D*. When the water has boiled remove the flame for a moment. Open *N* and *O* until the sulphuric acid has filled the burette to *B*. Close *B*, then close *O* and open *P* simultaneously. As the action becomes less replace the flame and when all evolution has ceased, boil as at first, keeping the water bottle always lower than the surface of the liquid in the burette. Allow sufficient water to flow through the jacket to prevent any undue rise in temperature. Finally close *D* and remove the flask. Fill the funnel *A-B* with a moderately strong solution of potassium hydroxide and a few cubic centimeters of litmus solution. With the water bottle on the table, open *B* so as to allow the potassium hydroxide to flow into the burette very slowly. Allow it to run in until the liquid in the tube remains blue. This will remove any hydrogen sulphide or carbon dioxide. Most of the acid may be displaced with water before using the potassium hydroxide. Allow the apparatus to stand with the cooling water circulating until the temperature is the same as shown by the thermometer in the barometer nearby. Open *I*, and with the thumb and finger on *N*, manipulate the water bottle until the liquid in the burette and that in the level tube are at the same level. Observe reading. This reading is corrected from Liebermann's table to what it should be at 0°, dry and 760 mm. pressure, equivalent to 1 g. of material, and multiplied by 0.002495 to find the value in terms of iron; H = 1.008; Fe = 55.9, one liter of hydrogen weighs 0.08987 g. The only error is due to absorption of hydrogen by the water and solutions used, and the apparatus may be standardized for this by making a determination with standard iron wire.

This apparatus could also be used for making a determination of carbon dioxide from a carbonate.

The Wise Gas Hot Water Heater.

A water heater for building warming, adapted to apartment houses, business buildings, and the like, for using natural gas as a fuel and built in sections so that one or more can be employed to suit the requirements, has been developed by the Wise Furnace Company. As indicated in the accompanying illustration, the sections are vertical

Wise Gas Water Heater for Heating Purposes.

and are built internally so that the water has to circulate three times across each section before passing into another section or into the horizontal section which covers the vertical sections. Outside the water passages each section is provided with wings or flanges as a means for offering to the hot gases a maximum amount of metal and consequently a maximum capacity for absorbing heat. The flanges of one section alternate with and lock into the flanges of the adjoining section, leaving space, however, between the sections and flanges for the gas passages, which, it will also be noted, are somewhat circuitous in order to give as long a gas travel as possible and therefore the best possible chance of utilizing heat. The horizontal section is provided in part to absorb any heat that may escape from the vertical sections.

An independent gas burner is placed under each one of the vertical sections. Each burner throws two rows of flames, one for each side of the section. The idea is that one burner will at one time heat three sections, that immediately over it and the one section on each side. It is intended that only alternate burners shall be used except in cases of extreme demand, while in mild weather it may be necessary to have only one burner in operation to keep the entire heating system sufficiently warm. The top and sides of the heater are lined inside with asbestos millboard to retain the heat.

The 3-section heater, including, of course, the top section, is rated to carry 450 square feet of radiation and the ninth section, for example, 1,350 square feet. It is recommended that an odd number of sections be employed on account of the ability to use alternate burners so that the two outside sections will be heated from an inner burner with a minimum loss of heat on the outside. Besides application where a coal burning boiler can be employed, the heater is regarded as promising much for apartment houses or business buildings where an independent plant can be installed for each tenant. It is held also that with this type of heater a basement is unnecessary, that the heater can stand on the floor to be heated and in an out of the way place. The possibilities of varying the supply of heat with a gas flame different outside air temperatures is, of course, pretty well known.

Absolute Failure of the New York Destructor Plant for Public Lighting Use.

New York's refuse burning plant as a means for lighting the Williamsburg Bridge across the East River has been abandoned and the Department of Water Supply, Gas and Electricity has called upon the New York Edison Company to illuminate the structure and to supply whatever additional electricity may be required. It will be remembered that this plant was described in the *Electrical World* of November 18, 1905. The destructor station is at Tompkins and Delancey streets, just beside the bridge, and was used by the Street Cleaning Department for destroying a portion of the city's rubbish, which heretofore was taken out to sea and dumped. The fuel was supplemented with coal at times for feeding boilers supplying steam to two 100-kw. and one 50-kw. electric generating units, the energy from which was used to supply the Williamsburg Bridge. It was estimated at the time that the plant would save the city about $10,000 yearly.

The generators supplied 180 arc lamps, 767 incandescent lamps, 3 electric motors and 20 electric heaters. The following data on the plant for the year 1906, during which time it may be said to have been operating under its best conditions, having passed the experimental stage, will doubtless be of interest:

Cost of incinerator, buildings, equipment and boilers	$62,092.28
Cost of generating plant, wires, lamps, etc.	60,255.34
Cost of operating incinerator, including repairs, supplies, coal and interest at 4 per cent	45,022.29
Cost of operating electric plant, including depreciation at 5 per cent. and interest at 4 per cent.	31,418.28
Actual saving to the Street Cleaning Department as compared to the cost of final disposition	8,052,67
Actual cost to the Street Cleaning Department to effect the above saving	35,969.62
Estimated cost of running the lighting plant with coal as fuel	57,232.00

It will be noted from the above figures that no charge is made for depreciation on the incineration plant, nor are any charges made for administration, taxes, etc. We regret that we are unable to obtain the total kilowatt hours of energy generated so as to give the cost of energy per kw. hour, as compared with the cost if supplied by a central station. The city's engineers, however, have been frank enough to admit that the plant was being operated at a loss and was unsatisfactory at all times as a lighting plant for reasons given below.

The incinerator has disposed of 39,647 loads of rubbish a year. Each load consisted of approximately 7½ yards of material; but this was reduced by picking and compressing to about 2½ yards at the furnace. A large part of the difficulty encountered in the work of keeping up steam in the boilers was the accumulation of slag, which choked the flues and ran back on the grates. This slag was caused by glass, sand, etc., in the rubbish which escaped the pickers. Besides this, the quality of the fuel caused great variations in the heat obtainable, and the necessity of opening the large feed holes for putting large articles, such as sofas, barrels, boxes, etc., into the fire, caused contractions which ruined the incinerators. These are now practically fit for junk; but the electrical equipment is in first-class condition and does not represent a total loss. The building also may be utilized for some other purpose or may be still retained by the Street Cleaning Department.

Another condition which was inimical to economical operation was the necessary rehandling of the rubbish. This came in during the day, and the lighting plant was run at night, so that in the meantime the rubbish had to be stored. In addition, the heavy lighting load came during the winter months and the quantity of rubbish gathered in winter is not near so much as is gathered in summer. The plant, moreover, was being operated by the Street Cleaning Department, while the benefits were derived by the Bridge Department. When the Street Cleaning Commissioner, in an endeavor to cut down expenses, abandoned the plant, matters were brought to a head, and inasmuch as the bridge had to be lighted and the Bridge Department had no appropriation for that purpose, it fell to the lot of the Department of Water Supply, Gas and Electricity to supply the electricity, with the result that a contract was made with the New York Edison Company at the Company's regular rates.

The Department of Street Cleaning claims that the plant was built by a former commissioner as an experiment and was never expected to furnish enough steam to run the generating equipment to light the bridge. If it had been successful, however, and there had been no change of commissioners, a larger furnace installation would have been made so as to furnish sufficient steam to run the generating equipment. The Street Cleaning Department could supply more rubbish than necessary, the plant only using about one-eighth of the rubbish gathered, and it would be folly to burn this unless some use were made of the heat. The experiment of lighting the bridge was the only means of utilizing this heat, and after a 2-year trial the experiment was found to be a failure.

Oil Conditions in California.

In Bulletin 6 of the California Petroleum Miners' Association, prepared by the Secretary, Dr. C. T. Deane, it is noted that Dr. Deane has changed his views considerably respecting over-production of oil in California. Here is something of his new doctrine in respect of the matter:

Among the many oil fields of California there are three that have proven themselves great producers. They are the Kern River, the Coalinga and the Santa Maria. Coalinga promises to surpass as years roll by even Kern in its acreage and production of oil. Its proven ground is being continually extended by the addition of new territory. Only last week a portion of the field which heretofore was considered as wildcat was drilled with a very large well. The fields north of Coalinga have not as yet proved themselves of permanent value. The southern fields of the State compared with the three districts above mentioned have been disappointing as far as a large, permanent output is concerned.

The production of crude oil in California in 1906 was about 100,000 barrels per day or 36,500,000 barrels for the year. This is not exact, as the figures are not yet all in. We believe 1907 will see the 40,000,000 mark passed. California is now and has been for some time the largest producing State in the Union.

The local consumption of oil is fairly provided for at present; the future increase will be caused by exportation. Japan has contracted for 10,000,000 barrels. The establishing of a pipe line across the Isthmus of Panama will give an outlet for large quantities, and the field in South America and the Orient is an ever-growing one. The price of oil has materially advanced during the past year, so that at the present time the owners of wells have nothing to complain of. They had to wait a long time, and many got impatient and thought that they could alter the old law of supply and demand, but when the real demand came, the price rapidly rose, and we think, unless something unforeseen occurs, that the price a year from now will be yet higher. It is not impossible that a new district, and perhaps a very large one, may be competing before another year, but it is yet too soon to indulge in hopes that may never be fulfilled. We congratulate the producers on the present very satisfactory price they are receiving for their product; we also believe it will last, for as consumption increases, as it is sure to do, many more wells will have to be drilled to make up for that, and also for deterioration of wells already in commission, which is generally supposed to be about 10 per cent. a year.

The oiling of the roads of the State is progressing rapidly, and the more remote counties are beginning to learn that they will be left severely alone unless they put their roads in passable condition. The bicycle craze of a few years ago commenced the improvement, and the present popularity of the motor car is rapidly bringing to the attention of our country friends the necessity of doing something in that direction. In 5 years' time we believe that a muddy or dusty road will be the exception; certainly, with the materials at our doors to make good roads, there should be no excuse.

At the time of the fire there were in San Francisco 500 fuel tanks, containing from 10,000 to 30,000 gallons of oil each. Notwithstanding the fact that for 3 days 118 of these tanks were surrounded by a mass of flames, not one exploded or took fire. The Fire Marshal, Mr. Charles Towne, in a letter to me dated June 1st, substantiates the above facts. Of course this was largely due to proper installation, one condition of which was that each tank should be at least 5 inches lower than the point of exit of the oil, at the furnace mouth, necessitating the pumping of the oil, instead of letting it flow by gravity. The fire marshal cannot be commended sufficiently for his determined stand against very strong pressure, and for his refusal, when oil was first introduced, to be lax in supervising the installation, for the purpose of saving a little money to those about to use oil-burning machinery. Certainly no graft in his department. Since the fire there have been 130 new permits granted.

Brooke's Regenerative Gas Retort Furnace.

English Letters Patent (No. 14,637, 1906 series) have been granted to Mr. R. M. Brooke of Elland, England, covering advances in "Regenerative Furnaces for Heating Gas Retorts." Reprinting largely from the inventor's specifications:

The main objects of this invention are to more fully utilize the heat in the gases leaving the setting for heating the secondary air on its way to the combustion chamber and to better regulate the distribution of the heat applied to various parts of the retorts, whilst obtaining a strong and durable construction of regenerator. The method by which these objects are attained consists, first, in keeping the hot gases in each of the compartments formed by the stay walls of the setting under separate control while passing through the regenerator, and, secondly, in keeping the secondary air passing through one series of flues in the regenerator separate from the secondary air in other flues until it reaches the combustion chamber. By dividing both the secondary air and waste gases into separately controlled streams, the draught through each compartment of the setting, and thereby the heat in each of such compartments, can be more effectively controlled than has hitherto been the case.

The secondary air is admitted at the front of the regenerator and travels backwards and forwards inside one, two, three, or more vertical series of horizontal tubes. Where more than one vertical series of secondary air flues are used, the air ascending each series is kept separate from the remainder of the secondary air until it reaches the combustion chamber, so that by regulating the ordinary dampers controlling the entrance of air to each flue, the distribution of the supply of secondary air to various parts of the combustion chamber is controlled. The ordinary stay walls, *i*, between the retorts, are prolonged downwards through the regenerator in such manner that the hot gases in the compartments formed between such stay walls are not all collected together until they reach the bottom of the regenerator, the gases in each compartment being divided into two, three or more downward streams in each compartment of the regenerator, according to the number of series of secondary air flues, and circulating around these secondary air flues so as to bring the maximum amount of hot gases in contact with the air flues, and, consequently, attain the greatest efficiency of the regenerator. By adjusting the dampers, after the main dampers have been set so as to give the required draught on the whole setting, the amount of hot gases in each compartment, issuing from the combustion chamber, and consequently, the heat on various parts of the retorts, can be regulated. It will be seen from Fig. 3, which is a plan on the line, *F–F*, in Fig. 1, that the air ascending one flue, as *a*, is passed through the uptake hole, *n*, into the rear end of a tube, *p*, ending in a channel, *r* (indicated also in dotted lines in Fig. 2, which is a section on line *C–D* in Fig. 1), and divided midway by a stop wall, *s*, whilst the air ascending another flue, as *b*, passes from the flue, *y* (Fig. 1) to the rear of a tube, *z*, returns to the front of the tube, *p*, and passes to the combustion chamber by the holes, *x*, so that the two streams of air, *a* and *b*, are, respectively, directed to the front and to the back of the combustion chamber, their respective quantities being regulated by the usual inlet dampers.

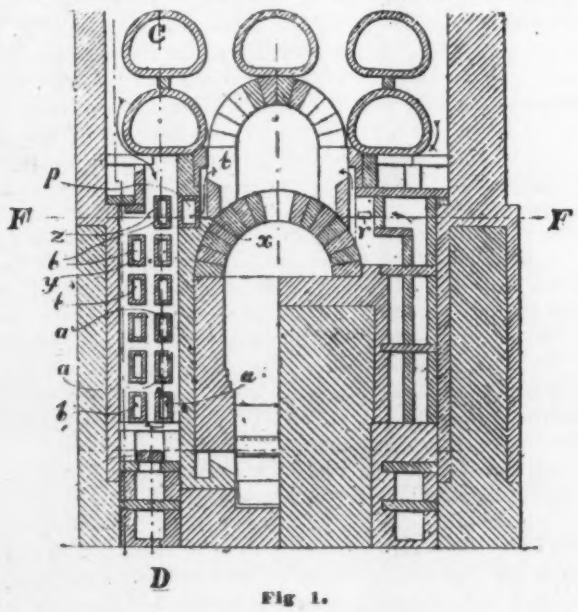


Fig. 1.

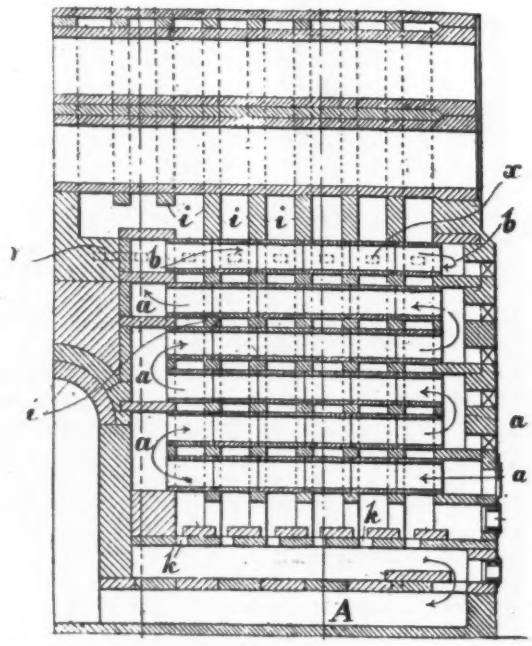


Fig. 2.

Where only one vertical series of secondary air flues at each side of the producer is employed, the flue at one side of the furnace leads to the back of the combustion chamber and the flue at the other side to the front.

A separate series of secondary air flues may, if desired, be employed, in connection with each air port opening into the combustion chamber; but in Figs. 5 and 6 an example is given of an arrangement where three flues at each side are employed, each flue supplying two such ports. The courses of the three ascending streams of secondary air proceeding, respectively, to the back, middle and front of the combustion chamber, are indicated at 1, 2, 3, and the spaces through which

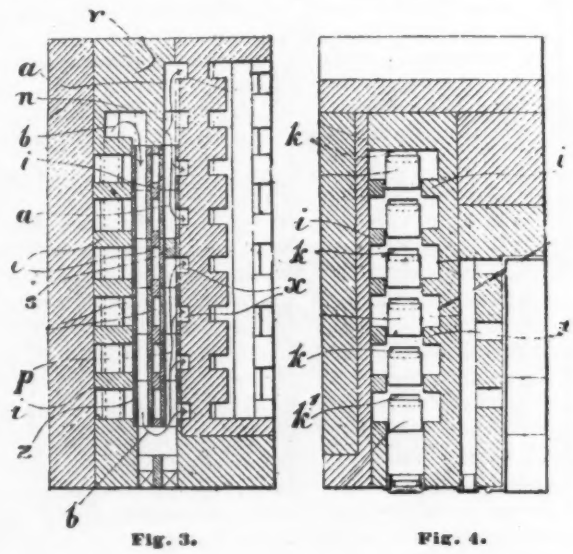


Fig. 3.

Fig. 4.

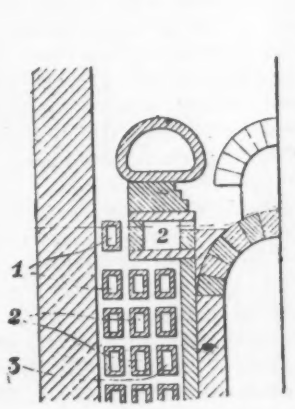


Fig. 5.

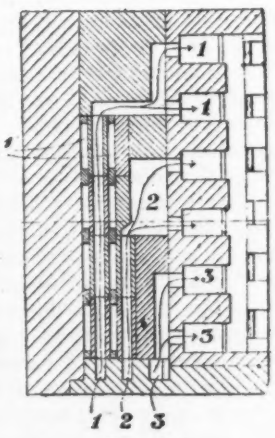


Fig. 6.

the waste gases descend by e^1. In all the arrangements the streams of air or exhaust gases are not only kept separate from each other between the inlet and the combustion chamber, but also from the combustion chamber to the apertures, k, this being the principal feature of the invention. Thus, supposing there were six apertures, k, as in Fig. 4, it may be found desirable that the front one, k^1, should be opened wider than the others, in order to increase the draught through the front compartment, and thereby the quantities of both secondary air and producer gas burned in that compartment, for the purpose of compensating for the loss of heat by radiation from the front of the retorts, which loss does not occur in the other compartments. When the general draught, as governed by the main damper, is represented as 7 parts, the draught through k^1 might, for example, be represented by 2 parts, and through the other 5 by 1 part each. This will be found much more effective than the known method of varying the sizes of the air ports leading to the combustion chamber, since the edges of the ports at the points of greatest heat are most liable to be burned away, thus increasing the areas of such ports; and it has been found impracticable to employ dampers for partially closing such air ports, the great heat fusing the dampers fast against the ports; whereas in the present arrangement the dampers are in a comparatively cool and accessible position.

Photometry of Different Colored Lights.[1]

[By M. Lauriol, Chief Engineer of the Public Lighting of Paris.]

I.—Briefly, it will be taken for granted in the sequel that (1) the absorptive power of the air can be neglected, and (2) the dimensions of the sources or groups of sources of light are indefinitely small in comparison with the distance from the objects illuminated. As most sources have different illuminating intensities in different directions, when the intensity of a source or the effect produced by it is spoken of, it will be understood that these expressions apply to a particular direction.

II.—Experience furnishes us with a first general law—viz., a source A, acting at a distance a, produces the same effect as a group of n^2 similar sources acting at the distance na.

When a source A is compared with a standard of the same color E, the intensityof A measured relatively to E is by the definition the ratio $\frac{e}{a}$, which results from the condition that a group of sources e similar to E produces under all circumstances the same effect as a group of sources a similar to A. The law set out at the beginning of this paragraph admits of another definition of intensity being given—viz., it is the ratio $\frac{u^2}{v^2}$ which results from the conditions that the source A acting at the distance u produces the same effects as the source E acting at the distance v.

III.—The intensity so defined has, in monochromatic photometry, a perfectly clear meaning, and is indeed an inherent property of the source under consideration. The figure found is independent of the mode of measurement, and of all the circumstances of that measurement, of the nature of the effect which one endeavors to balance, of the absolute values of the numbers a and e on the one hand, and u and v on the other hand, etc. All the modes will theoretically be equally good; and choice will be guided simply by considerations of convenience or of exactness. The intensity of a group of sources is equal to the sum of the individual intensities of each source. The relation between the intensities of the two sources is independent of the common unit by which they are measured. To sum up, it is justifiable to state that the intensity so defined gives an exact measure of the value of the source.

IV.—When two sources of different colors are compared, the conditions are changed. The effects produced by two sources will not always be the same; but in certain cases it will be possible merely to judge that they are equivalent. This judgment carries a greater uncertainty the greater the difference between the two colors. Further systematic differences are introduced, depending on all the conditions of measurement. A source of light no longer has a certain intensity, but an infinity of intensities according to the mode followed, and with the same mode according to various numerical experimental data. The principal causes of variation will be enumerated later. Then there is the radical and absolute impossibility of saying that a source A is twice or three times the value of another source B. All that can be said is that in a first case, a second case, or a third case, the source A had a value twice, or 2½ times, or thrice the value of B. Which figure is to be chosen to represent the value of the source A? Scientifically, all these figures are properly applicable, if the conditions under which the measurement was made have been clearly defined. Practically, if a batch of conditions can be found corresponding more or less to the customary conditions of use of the sources of light, the measure thus made will give a more or less satisfactory measure of the value of the source.

Let us take an example from a somewhat different order of ideas. The relative volume of two masses of gas is a well determined quantity, if the two masses are similar in character and both are at the same temperature and pressure, whatever that temperature and pressure may be. On the other hand, the number of liters occupied by a given mass of gas is not definite; and no one can say, without further qualifications, that a kilogramme of air occupies 1,000 liters. If, however, it is known that the temperature and pressure vary only within certain sufficiently narrow limits, it will be possible to say that a kilogramme of air occupies a space of 1,000 liters. The case of the photometry of lights of different colors is quite analogous.

Various definitions of the intensity of lights have been selected from among the many available. For instance (1) the relative intensity of the sources after filtration through a monochromatic screen which allows only certain radiation at the limit of the yellow or the green to pass; (2) the limit towards which the relative intensity approaches when the illuminations approach zero; (3) the integral of impressions obtained on a photographic plate by making each radiation act in succession for a given time, which is a function of the wave length. None of these definitions is *per se* good or bad. Do they correspond with the average conditions in practice? That is the only question. To accept or reject one or the other, comparison must be made with the average conditions in practice. After that, it is easy enough to take at the outset these average conditions, and to make the measurements directly under the conditions. This is what the author proposes trying to do, without making any pretence of avoiding arbitrariness, but only giving it as small a part as possible.

V.—At the outset, we may somewhat ingenuously recall the fact that the sources of light enable us to see the illuminated objects. To keep to the general practical case, we ought only to depend on phenomena of light, sensible to our eyes, and consequently to photometers properly so called, and so to exclude apparatus such as the selenium pile, bolometers or photographic plates. The figures thus obtained will evidently have no particular value for a medical man, who looks for certain physiological actions by a focus of light, or for a photographer, who looks for certain chemical effects, etc. But it is necessary to keep within limits.

VI.—Various physicians and physiologists—among other M. André Broca—have shown the influence which fatigue of the eye, more or less severe, and the duration of the impression of the light, cause on measurements. In an analogous train of ideas, the author has found variations of 20 per cent. in the relative intensity of a Nernst lamp and an ordinary electric glow lamp, according as it was measured with the Simmance-Abady flicker photometer as normally worked with the disk rotating, or with the same photometer with the disk at rest so that the quality of illumination was judged on the two juxtaposed surfaces at rest. Practically the objects, whether fixed or moving slowly, which are being observed, retain constant illumination for an infinite period (*i. e.*, a second or more); they are observed with an eye which has received the impression of the surrounding light for an infinite period (a second or more), and is fatigued to an extreme extent. We shall have to work under these conditions, which are those obtaining in all photometers with fixed surfaces, to the exclusion of flicker photometers.

VII.—The apparent diameter of the surfaces of observation appears to have an influence, which is still imperfectly known, on the results of the measurements. It would appear that, according as this diameter varies, the image reaches or fails to reach various parts of the retina of varying susceptibility to impressions. Practically illumination is of most value to us in the direction determined by the eye, or in its vicinity. Consequently, tests should be made to ascertain a maximum limit for the diameter viewed, below which we ought always to stop.

VIII.—Objects of every color have to be observed set on backgrounds of every color; and in this lies the possibility of the relative values of two sources varying to a very great extent. A weak source of green light will be superior to a powerful source of red light, if green objects have to be distinguished on a black ground or red objects on a white ground, or *vice versa*. A single measurement of the

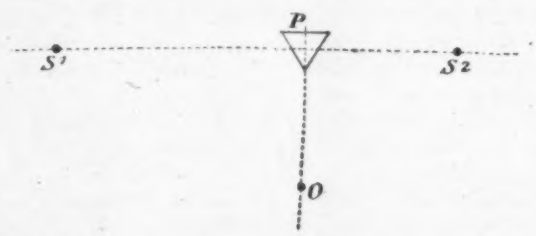
1. *Journal of Gas Lighting.*

relative intensity of the two sources will therefore give a figure differing very greatly from their true relative value under different conditions. The least objectionable solution in such a case will be to compare the illumination of two white surfaces, just as is done in the majority of photometers.

IX.—The intensity found varies with the absolute illumination, this is one of the facts which have been investigated longest. For instance, the intensity of a Nernst lamp, measured relatively to that of an ordinary electric glow lamp, has been found to vary between the ratios of 100 to 80 and 100. In this instance, the absolute illumination varies within less wide limits than those between which it varies in practice. In this special case, it is noticeable that the variation is not in a constant sense. It is scarcely possible to choose an average condition. There are variations from 1,000 *lux* to 0.1 *lux* between the maximum illumination of a work table and the minimum illumination of a public street. In general, the sources ought to be tested over these limits; but it is between 50 *lux* and 0.5 *lux* that the measurements are specially of interest.

X.—The intensity found varies as a function of the absolute illumination, but of the absolute illumination of what? Clearly it can only be as a function of the illumination of the images on the retina. Therefore every cause which produces variation of the illumination of the images on the retina, while the illumination of the photometric screen remains constant, will produce a variation in the figure found for the relative intensity of two sources. If, when making an observation, we wink, or obscure the pupil of the eye, we cause the illumination on the retina to vary, and we observe variations of the apparent relative intensity. This fact has been pointed out by M. Laporte. It will be seen that only one thing can be done in this connection—viz., to keep the eye naturally open when making an observation, and to compare the results obtained by different observers.

With identical illumination of the photometric screen, the illumination on the retina varies with the photometer used, according to the reflections, refractions, diffusions, and absorptions inherent to each instrument. Also, it will be found that, for the same distance between one of the sources and the photometer, the apparent intensity varies with the photometer used. We ought therefore to select a photometer which reduces to a mininum all these modifications of the light, and which shows us the screens as nearly as may be like we see objects in general practice. Generally we observe matt opaque surfaces at all possible angles of incidence. As an average, let us assume that the incident ray and the visual ray are perpendicular to one another, and are both at 45° to the vertical. Between the source and the eye, the light undergoes no other modification than diffusion at the surface of these objects. It ought to be the same with our photometer. Therefore the author suggests the following method with which some observations have been begun. On a rectilinear horizontal bench are mounted the sources of light S^1 and S^2, and the photometer P (see annexed figure). The latter consists of an isosceles



rectangular prism, with vertical edges. The plane bisecting the angle ought to be perpendicular to the direction of the bench. The eye is put at O in the bisecting plane, at the same height as the photometer and the sources of light. The prism is made of plaster, unglazed porcelain, or any other white matt material. The edge of the facing angle ought to be as sharp as possible. Equality, or at least equivalence of the illumination of the two lateral faces of the prism, is obtained by moving either the photometric prism or the sources of light.

Such a photometer affords a less precise observation than others—such as the Lummer-Brodhun; but it comes nearer to the average conditions of practice, and avoids systematic errors. There is greater reason still for discarding photometers in which the light traverses a translucent screen, like Foucault's photometer, and more particularly the grease-spot photometer, as the phenomena differ too much from the ordinary conditions of practice.

XI.—The intensities being thus measured, the following law (which the author brings forward with all reserve, as it has not yet been sufficiently verified) appears deducible from the tests: *Two illuminations which are equal to a third are equal to one another.* Suppose that the two following results had been found:

The source A at the distance a is balanced by the source C at the distance c.
" B " " b " " " C " c.

Then the law cited would indicate that—

The source A at the distance a is balanced by the source B at the distance b.

If this law were more completely verified, granting the laws of variations of the relative intensity of two sources A and A, and of two sources A and C, we should be able to deduce from it the law of variation of the relative intensity of the two sources B and C. Thus, from the two data—

A at the distance a is balanced by B at the distance $f(a)$;
A " a " C " $F(a)$;

we should deduce that

B at the distance $f(a)$ is balanced by C at the distance $F(a)$.

Giving a all possible values, we should then have the law of variation of the relative intensities of B and C. Given the law of variation of intensity of a source by reference to a primary standard, and that of this standard by reference to a secondary standard, the law of variation of the intensity of the source in relation to this secondary standard may be deduced.

XII.—When all this is done, there are still troublesome considerations in the way of conducting the photometry of lights of different colors, which at any rate render it necessary to make very numerous observations in order to get a result having any meaning. The intensity of a group of sources of light is, generally speaking, different from the sum of the individual intensities of the sources. There is notable inequality in the case where each source is placed separately, and later the whole group, at the same distance from the photometric screen.

The law of variation of the intensity of a source, as a function of its distance from the photometric screen, will not remain the same if the standard used for the measurement is altered. If the intensity of the standard is simply modified, without altering its color, a curve can be deduced from the other curve by increasing or diminishing the ordinates in constant proportion. If the color of the standard is modified, measurements such as those indicated in Section XI. will have to be resorted to. Generally, it will be inexact to multiply the ordinates of a curve by the ratio of the intensities of the two standards, as determined by a single observation on any photometer, and with only one distance between one of the standards and the photometric screen. In particular, for comparing the three standards, the Carcel, the Harcourt and the Hefner, it would be interesting to have a detailed investigation made with various illuminations and various photometers.

XIII.—Though the intensity of the standard is theoretically a matter of indifference, its color is not. As comparison with natural sunlight is desirable, a standard should be chosen which comes as near as possible to the color of sunlight when atmospheric absorption is at a minimum. So judged, the Carcel and the Harcourt standards appear superior to the Hefner. Perhaps a better may be found.

XIV.—In many cases comparison is between lights of almost the same color, and no comparisons have to be made with other lights of different colors. For instance, in comparisons of Welsbach burners of different makes one with the other, the chief interest lies in ascertaining their value relatively to one another without troubling greatly about their value relatively to a Carcel lamp or an electric arc. Or the variations of intensity of a source of light with change of direction might be studied. In each of these cases it would be convenient to adopt a special standard of appropriate color rather than to refer both to the same standard. For instance, special standards would be used for Welsbach mantles, others for hydrocarbon flames, others for incandescent electric carbon lamps, others for lamps with metallic filaments—such as the osmium, tantalum or tungsten lamps—others for ordinary arc lamps, and others for flame arc lamps. Comparison rests each time only between two sources of the same color, and there will no longer be any reason for limiting oneself to the use of the photometer mentioned in Section X. In order to make the tests carried out in different laboratories comparable, it would be possible, for instance, to start with the general standard mentioned in Section XIII., and to filter the light through various colored screens, either of thick glass of well defined composition, or of liquids, as in Crova's green screen.

XV.—The various causes of variation of the apparent intensity of two sources will have so much the less effect, and may be so much

the more readily neglected, when the colors are but little different, and no very great degree of precision is aimed at. It is important to make long series of measurements on this point, principally with colors much whitened, as is the case with the most general sources of light. The collaboration of numerous laboratories would be useful to this end.

XVI.—To sum up, the author submits this programme: Try the photometer described in Section X. Investigate the discrepancies due to difference of eyesight. Investigate the effect of the apparent diameter of the screens, and, if it seems desirable, fix a maximum diameter (Section VII.). Compare the Carcel, Harcourt and Hefner standards with the photometer described in Section X., and investigate the variations of relative intensity as a function of the absolute illumination and of the various photometers employed. Verify the law of illumination referred to in Section XI. Choose a primary standard having, as nearly as may be, the color of solar light (Section XIII.). Choose secondary standards having the colors of the various common sources of light (Section XIV.). Make measurements of intensity in the photometry of different colors for illuminations varying from 1,000 *lux* to 0.1 *lux*, and in particular for illuminations ranging from 50 *lux* to 0.5 *lux*. Investigate the degree of approximation to accuracy with which it is possible to assign a particular intensity to each of the various common sources of light (Siction XV.).

Test of a Gas Producer Electrical Plant.

Mr. L. J. Corbett writing to a contemporary on this subject says:

One of the first plants in the Northwest to use producer gas as a source of electrical power is that of the Pasco Light and Water Company, at Pasco, Wash. The results of a test made on Thursday, April 26, 1907, were highly gratifying to the promoters of the company, the engineers and the manufacturers of the equipment, and will no doubt interest all those now investigating the economy and reliability of producer gas for electrical purposes. The fact that a Western coal was used for the test, not anthracite or coke, makes it of particular interest to Western engineers who are concerned chiefly with bituminous and lignite coals, and are far from the anthracite and coke producing districts.

The plant is of 100-horse power capacity and is to handle a pumping load of from 30 to 40-horse power, and a lamp and motor load which will increase with the size of the town.

The gas is generated by a Smith suction producer, and after being passed through a scrubber and a purifier, is admitted to a 100-horse power Rathbun 3-cylinder vertical type engine. This is belted to a General Electric 3-phase, revolving-field alternator operating at 2,080 to 2,300 volts per phase and 60 cycles per second.

The pumping plant is located about 7,400 feet from the power house and is operated by a 40-horse power induction motor of the squirrel-cage type placed directly on the line at 2,080 volts. The line from the power house to the pump house consists of three No. 8 hard-drawn bare copper wires spaced 14 inches between centers. The pump house is placed over a concrete well 24 feet deep in which is set a submerged triplex pump with a capacity of 400 gallons per minute. This draws water from the Columbia river 150 feet away and delivers it to a 10-inch main of wood stave pipe which leads through the town of Pasco to a tank on a hill about 1 mile east of the present center. This tank has a storage capacity of 100,000 gallons and gives a head of 78 feet above the grade at the Northern Pacific tracks near the present depot site. In case of fire the pump is to furnish a direct pressure of 65 pounds per square inch at the hydrants.

When the installation of the system was about completed the test was made. A non-inductive load was placed on the generator at the power house. A water rheostat consisting of 3 barrels connected in "Y" was rigged up with iron tie plates for terminals, the resistance being varied by the use of a little salt and by raising and lowering the terminals connected to the outer leads.

The attempt was made to carry a load on the engine of 100-horse power, but such careful attention was needed to maintain the load at a certain point that it was decided to take readings and adjust the load every 15 minutes for a portion of the time and every ½ hour part of the time. Then an estimate was made of the average load carried by the engine and the horse power hours calculated.

An interesting incident in connection with the test occurred after about 3 hours' run. The engine seemed unable to carry the load and maintain its speed. The speed decreased so that it was impossible to keep up the voltage, and the sky looked blue for the gas equipment. After various guesses as to the difficulty the correct remedy was applied, which consisted in turning on the water regulator on the engine, thus enriching the gas with aqueous vapor, whereupon it immediately picked up and carried the full load just as easily as it had when first starting up in the morning.

The coal had contained moisture in a sufficient quantity to yield a satisfactory gas when the load was first put on, but after the 3 hours' run the moisture had so far evaporated that the gas was dry and the operation of the engine was seriously hampered. The use of the water regulator is considered unnecessary by some builders, but it certainly showed its usefulness in this instance.

The rheostat load was held for another hour and then cut out and the pump load substituted. This load varied from 22.1 to 29.5-horse power as the head in the pipes increased. Readings were taken every 15 minutes.

The total duration of the test was 7 hours. At the start the producer and engine had been running light for about 1 hour so everything was in working order. The height of the coal in the hopper was noted and the state of the fire. Coal was added as needed and the weights recorded. At the end of the test the fire was in the same condition as at the start and coal was placed in the hopper up to the same height as when the test commenced, as nearly as could be estimated.

The number of horse power hours was 512.9, the weight of coal used, 696 pounds, showing a result of 1.35 pounds of coal per horse power hour delivered to the belt.

The coal was called a washed lignite nut, from a mine of the Wilson Coal Company at Centralia, Wash. This car load was delivered at a cost of $4.15 per ton; thus the cost of coal per horse power hour was less than 3 cents. It was badly slacked and contained considerable impurities in the shape of earth and clay.

After the test two or three large clinkers were drawn out of the producer weighing in all 64 pounds. Pending an analysis and thorough test of the coal, it is uncertain whether it is a coking coal and not a true lignite; or perhaps the impurities consisted of siliceous ingredients or a form of fireclay, these solidifying into the clinkers mentioned.

Coal was put in twice during the test and again at the end of the test to fill up the hopper. In regular running once would have sufficed for the day's run, besides the hopperful to start in the morning.

The water system was laid out by Mr. Otto A. Weile, a civil engineer of Spokane, who had complete charge of the work. The writer was in charge of the electrical features.

Isolated Electric Plants.

By Mr. W. H. Stuart, in *Elec. World.*

A great many companies have never pushed the matter of obtaining the business done by private plants. A large illuminating company after making a thorough canvass of its territory obtained information as to the why and wherefore that isolated plants were installed, the cost of installation and operation, the amount of energy produced and also noted the comments offered, favorable and otherwise, in regard to the plants. They then rested in the matter, doing nothing further. In the course of the year, correspondence was opened with the company by several isolated plants, asking for information as to the company's service, which finally developed on the part of a few isolated plant owners making applications for break-down service. This business was accepted only where no extension of reinforcement of the mains was needed. The rate per unit of energy was the regular one, that of 12 cents. A minimum charge of 10 cents per 16-candle power equivalent of the connected load was made. This business was not desirable, as the proportion of the central station's investment that class of business took could be used in other directions to a greater financial advantage.

But when this central station found that it could obtain all of the business in the near future, or all of the additional equipment that was to be installed, the minimum charge was reduced proportionally as the nature and quantity of the prospective business warranted. No set or established charges were maintained in regard to such consumers, but the matter was left rather to the business judgment of the official having authority in the case.

In the city of New York, when the legal standing of such a high rate and minimum charge was questioned, it was finally decided that such could be legally charged on account of keeping so much of the investment working at a loss.

It is in the manufacturing districts where isolated plants are to be found more frequently than elsewhere. Of course, in the large cities

these small plants will be often found in hotels, large apartment houses and the department stores, and they range in size from the pony generator, driven with the small, sputtering gas engine, to that of a central station. Every manufacturer has got to have motive power, and his whole thought in the matter is how cheap he can procure it. He does not care if the prime movers are in his building, owned and operated by him, or whether a mile away in a central station. What determines where and what they shall be is the expense account in his ledgers.

I once asked a large manufacturer why he had installed a plant of his own and he told me that, all things considered, he could produce electricity cheaper than he could buy it. He was afterwards shown items he had not considered, and starting with a break-down connection, his plant was finally sold as scrap and central station service installed. He did not require steam in his factory for any purpose save for running his engines, and this fact made the case easier for the new business department. The auxiliary use of steam plays an important part in isolated plants. In fact, it is a big obstacle to be overcome when opposing the installation of and arguing for the abandonment of isolated plants.

The policy of the illuminating company has a great effect upon this side of the "new business" situation. If it is broad minded, progressive and aggressive, it extends every possible advantage for business to be obtained. It is the open, helping hand policy that tells. It has been found that when asking from the owners correct and authentic information concerning the various items and costs of isolated plants with a view to a comparison, the success lay, despite what the representative said, with the impression that was held of the policy of the company by the private plant owners.

In one case where a manufacturer was approached by a representative of a lighting company, he refused to discuss the matter in any form whatsoever. His impressions were that the company having a monopoly of the field, was only trying to throttle all the small plants and was making overtures to obtain information to inveigle him into giving up his plant and then treat him as it saw fit. What was done with this concern was to change his impressions by presenting to him in every way possible instances showing the error of his views.

In the same city within a stone's throw of this concern, lay the plant of another manufacturer, who was approached on the same day. While he had never had any dealings with the central station he stated that he was open to receive any proposition to purchase energy providing he could do so as cheaply as he made it. He stated in regard to his feeling towards the company that he believed it was anxious to increase its business in every way, honestly and fairly. This he judged from the statements published in the newspapers during a publicity campaign.

Many a plant has been installed through misunderstanding, petty squabbling, obstinacy and disagreements which, had they been set aside, would have prevented such installations. The location and capacity of the mains prevent, sometimes, business of any size being connected, although when any return on the investment can be made it would prove perhaps good business to make extensions or reinforcements.

When figuring the cost of operating an isolated plant a great many items are overlooked or do not receive their proper value and sometimes none at all. The items given to me as those which the owners figured as constituting the operating expenses of a plant of some proportion, were labor, coal, water, oils, removals of ashes, repairs and sundries. When the actual cost of these items was computed, it was found that the plant was a money saver, the cost per unit of energy being about one-half that of the figure submitted by the central station. No price at all, however, was placed upon the rate of depreciation, nothing for insurance, no interest upon the investment was computed, the time and bother due from break downs and the constant thought and worry for its smooth operation were never assessed. When a fair value was placed upon those items and the whole used as a cost basis, the result proved to come to considerable over the illuminating company's figure.

One of the large trunk line railroads at its eastern terminal was allowed a certain figure to operate its own electric light system. This covered its terminal shed, office building, yards and piers. To keep within its appropriation and light the premises it was found that they had to produce energy for about 3½ cents per kw.-hour. With the big advantage of obtaining supplies, namely, coal, water, oil, etc., at a very low figure, it was found that they exceeded their yearly appropriation. This was allowed to go on for several years when a halt was called. Application was made to the illuminating company for service and a flat rate of 6 cents per kw.-hour was given, doing away with the plant. This brought the lighting account to a little below the allowance with no other expense and perfect service.

A plant is like any other article purchased, the more that can be got out of it, the greater the value. If it is made to run generators, heat buildings, do compression work and any number of various things in the different industries its usefulness is more apparent. It is the side uses apart from generating motive power and light that make it very hard to have an isolated plant replaced by central station service. If the plant as a whole or the electrical portion of it is discarded, the reasons which have brought about the change would be found most likely that the uncertain costs have proved to amount to more than they should. That is, the responsibility, losses through break downs, etc., have proved to cost more in the end than the actual savings in dollars shows on the ledgers.

Direct Current from Alternating Current: The Mercury Rectifier.

Mr. Frank Conrad, in a paper read by him at the Washington meeting of the National Electric Light Association, remarked that within the last few years considerable attention has been paid to the development of the mercury rectifier for converting alternating into direct current. As it is apparent that this device is to play an important part in the betterment of central station economics, a description of some of the latest developments in this line may be of interest at the present time. The rectifier in its usual form consists of a glass bulb containing two positive electrodes, or anodes, and one negative electrode, or cathode. The bulb is exhausted to a high degree of vacuum and sealed. The anodes are connected to the terminals of the transformer supplying the alternating current, the connections for the direct current supply being made between the cathode of the bulb and the middle of the transformer winding. During one-half of the alternating current cycle current flows from one of the anodes through the bulb to the cathode through the direct current load to the middle point of the transformer. During the next half of the cycle the polarity of the transformer terminals is reversed and current flows out of the other anode through the cathode to the load. The positives, due to their surface electrode resistance acting as valves, allow the current to flow out, but not in a reverse direction, the resistance of the negative terminal being broken down by the starting operation, so that current can flow into that terminal only. Should the current be interrupted for an instant the negative resistance will reassert itself and the rectifier will require restarting. Therefore, to bridge over the neutral point of the alternating voltage wave it is necessary to give the direct current circuit a certain reactance which will store up sufficient energy to maintain the current flow over the zero of the alternating current voltage.

The negative electrode resistance or valve action of the electrodes is not an absolutely rigid condition, but is influenced in a number of ways, chiefly in the shape of the containing bulb and the temperature at which it is operated.

To obtain a minimum loss in the bulb, the path between the electrodes should be as short and direct as possible. With a short, direct path, especially at high temperatures, there is a tendency for the electrode resistance on the positives to break down—or, in other words, for the bulb to short circuit. This, may, in a measure, be overcome by operating the bulb at low temperatures, and to obtain this condition it is necessary either to give the bulb considerable radiating surface or resort to artificial cooling. The preferable way, especially for high voltage, is to cool the bulb by immersing it in oil contained in a tank having a comparatively large radiating surface. By this means it is possible to use a construction that will give a minimum of loss and still be free from any tendency to short circuit.

The voltage to be applied across the positive terminals is determined by the direct current voltage required and the losses in bulb and auxiliary apparatus. As current is drawn from one-half of the transformer winding only, the direct current voltage will be one-half the total alternating current voltage. In addition to this, as the direct current voltage is the average of the rectified alternating current waves, while the value of the alternating current voltage is expressed as effective, it will be reduced by the ratio of the average to the effective, which in a sine wave is 0.9.

The voltage of each half of the auto transformer in an outfit delivering 110 volts direct current would be 100 plus the loss in the bulb (approximately 15) plus the loss in the choke coil (approximately 4) divided by 0.9, a total of 143, or approximately 286 volts across the

anode terminals of the bulb. A reactance is placed in the direct current circuit to give the necessary bridging over the zero point.

To put the outfit in operation it is necessary to break down the electric resistance of the cathode. This is accomplished by a small arc produced between the mercury forming the cathode and that in a small auxiliary electrode. The bulb is tilted so that the mercury in the two electrodes makes contact, thus closing a local circuit which at the break produces the small arc necessary for starting. The efficiency of an outfit of this character is high compared to that of a small motor generator set. It is determined mostly by the voltage of the direct current circuit, as the voltage loss in the bulb is practically constant, irrespective of the total voltage of the circuit or the current delivered. As stated before, the loss in the bulb amounts to about 15 volts; therefore, to obtain 110 volts direct current the voltage of the transformer should correspond to a direct current voltage of 125; the efficiency of the bulb thus would be $\frac{110}{125}$ or 88 per cent. With an efficiency of the transforming apparatus of 90, the net efficiency of conversion from alternating to direct current would be over 79 per cent. The efficiency of a small motor generator set would probably be 60 to 65 per cent. The power factor of the outfit, when used without adjusting the reactance in the alternating current circuit, would be about 90 per cent. When used with this reactance it will, of course, be lower. It should be possible, however, to operate with a power factor of 80 per cent.

As to the general operation and efficiency of the rectifier outfit, the results obtained are far superior to that of a constant current generator. The percentage of loss in the bulb is practically zero, amounting to less than 1 per cent. in an outfit supplying 50 arc lamps. The losses in the regulating transformer and reactance will total about 80 per cent. more, which will give a total efficiency of conversion from alternating to direct current of about 90 per cent.

Electric Lighting in Germany.

In the paper prepared for the meeting in Washington of the National Electric Light Association, which did not come to hand in time for consideration there, by Prof. Dr. Phil. G. Klingenberg, of Berlin, Germany, the author describes the electric light conditions in that country. He points out advantages presumed of electricity over gas for illuminating purposes and also wherein the high price for electricity forms a hindrance to its rapid introduction. It has become quite general to divide the annual cost of the generation of electricity into constant expense and variable expense. On this basis the constant expense with modern steam central stations of average size is between $20 and $32.50 per kw. per year. The variable expense is between 0.6 cent and 1.25 cents per kw. hour. From these figures the author shows that the extra cost per kw. hour, incurred through an increase in consumption, the capacity of the plant remaining the same, is very slight. The tendency of consumers on the other hand is to reduce their expense for lighting by burning lamps as little as possible. On this account central stations have charged special rates to long consumers by introducing tariffs with a certain fixed rate of charge calculated on the maximum power demanded and an additional price per kw. hour shown on the meter. To charge a consumer the same rate for a lamp which does not burn often as for another lamp which is lighted is no doubt a hindrance to the introduction of electricity. The double tariff extensively applied in Germany overcomes this difficulty. A normal charge is made for electricity during the time of greatest consumption, but at other times the price is very much lower. An advantage resulting from this system is that the motor load and the lamp load do not overlap to the same extent as they do where the single tariff or a maximum tariff is in use.

The author then considers the influence of potential on electric lighting. Contrary to American practice preference has been given on the Continent to a circuit pressure of 2 by 220 volts, on the assumption that a loss of 10 per cent. to 12 per cent. in the economy of high tension carbon filament lamps is more than balanced by a saving in interest and depreciation in the network. A reasonable tariff and low initial expenditure with the accompanying low rates lead to a general introduction of electricity and help to overcome the competition of gas. The price of electricity is, however, still higher than that of gas, and were it not for certain improvements in incandescent electric lamps, the development of gas lighting and the introduction of inverted gas burners might have seriously hampered the further introduction of the carbon filament lamp.

Dr. Klingenberg here notes the improvements made in Nernst and in incandescent electric lamps and shows their superiority over the older lamps. He draws attention to the fact that the high efficiency lamps are at present only made for 110-volt circuits, and states that replies to a circular inquiry addressed to managers of central stations in Germany show that a large proportion of the engineers are in favor of a potential of 110 volts, the present standard being 220 volts. The author is of opinion that the introduction of 220 volts during the time when no other than carbon filament lamps existed was a mistake, so far as lighting circuits were concerned, since the cost of electricity was increased because of the fact that the 220-volt lamp was not as efficient as the 110-volt lamp.

Engineers now consider it absolutely necessary to return to 110 volts whenever possible and to stop carrying out new installations for 220 volts. The author is of the opinion that eventually a high efficiency, 220-volt lamp will be forthcoming, although a less sanguine manufacturer states that it will not be possible to make 220-volt, high efficiency lamps on a large scale until the process of manufacturing 110-volt lamps has reached a very high state of perfection and the price of the lamps has come down in consequence. It is evident that lamps for 220-volt circuits must have very long filaments and the natural result will be a very high percentage of breakage during manufacture, in transit and in use. Dr. Klingenberg is not to be weaned, however, from the 220-volt system and maintains that new schemes should be based on a supply of 2 by 220 volts as heretofore in spite of the contrary opinions expressed.

With reference to arc lamps, the author believes that the smaller sizes of arc lamps, consuming 2 amperes at 110 volts, must give place to the high efficiency, incandescent lamp. He considers the 500-candle power arc lamp the smallest that it is worth while to make, and states that the arc lamp industry is already preparing to meet a future demand for more light out of doors. Units giving 5,000-candle power are not beyond practical requirements in roads and places where traffic is congested, as is proved by the lighting of the Potsdam Platz in Berlin with 8 flaming arc lamps each consuming 20 amperes. The lamps are mounted on two high posts so that the burning point is fixed at a height of 18 meters above the level of the road. By this means the source of illumination is not disagreeable to the eye and the lighting of the square is as uniform as possible, the total light given by the lamps approximating 40,000-candle power. The author points out the disadvantages of the luminous arc, such as the color and flicker in the light itself, the expense of trimming, cleaning, etc. Brief mention is made of the advantages of the mercury vapor lamp.

Business Methods in the American Gas Industry.

Mr. Henry L. Doherty had occasion this summer to take an European trip, and naturally enough, knowing that all English roads lead to London, in due time he found himself in the heart of the British Empire. Also naturally enough, an interviewer of the *Gas World* found him out and this speech resulted between them:

There is at least one American gas engineer in this country this summer, and though he is here mainly for rest he has been looking around and taking mental notes. And one of these notes is not particularly flattering to us. He has not been favorably impressed with any of the show pieces of street lighting that we are sometimes inclined to boast about. The only consolation is that the faint praise he bestows upon English lighting is also extended to the lighting of Paris, to which we have been accustomed to turn for an example of how such work should be done. It is not so much the quality of the actual street lighting that our visitor is disappointed with as the little aid it derives from the outside lighting of shops and other premises. In the United States it is the practice of business people to light the exterior of their premises on a very lavish scale—the whole building being often outlined in points of light—and it is the general absence of this sort of thing in London and in Paris that has surprised our visitor. "I could take you," he remarked, "to a little town in the wilds of Nebraska which is a perfect blaze of light." "I have seen nothing like it in my travels here," he continued, "and I only mention this town as an instance of the general practice in practically all the towns of the United States." The street lighting of Paris, he admitted, is very pretty—so far as it goes—but there is not enough of it to satisfy the eye of the man accustomed to American lavishness in this regard; and the gloom of the buildings both there and in London is a continual wonder to him.

And our visitor is entitled to speak with some authority, for he is

Mr. Henry L. Doherty, a well-known gas and electric engineer, who is largely interested in lighting enterprises in many parts of the United States. Before going into the lighting business on his own account, in 1906, Mr. Doherty was associated for some 8 or 9 years with the lighting enterprises of the Emerson McMillin Company, of New York, so that his experience has been extensive and varied. At present Messrs. Henry L. Doherty and Company control and directly operate a large number of lighting undertaking in the States of New York, Ohio, Pennsylvania, West Virginia and Colorado; so that Mr. Doherty's acquaintance with American lighting matters is by no means local. The esteem in which Mr. Doherty is held by his fellows in the United States is sufficiently indicated by the fact that he is Second Vice-President of the American Gas Institute. Indeed, Mr. Doherty has done a lot of good work for the associated gas managers of the United States. If we mistake not it was he who originated the now familiar "Question Box" and "Wrinkle" departments; and he took an active part in the recent movement which resulted in the amalgamation of three of the strongest gas associations into what is now known as the American Gas Institute. He has also taken an active part in the education of gas engineers, which naturally led him to become a member of the American Society for the Advancement of Engineering Education. And here it may be mentioned that Mr. Doherty holds decided views as to the management of gas engineering and similar technical associations. In America, as in this country, some of these associations have suffered in the past from falling into the hands of coteries, and, as a consequence, they were allowed to drag out a very humdrum existence, without doing much good to anyone or to anything. Fortunately, this state of things is rapidly becoming a thing of the past, thanks largely to the efforts of Mr. Doherty and his supporters. That the organization of a technical association should be such that every opportunity should be given to the willing worker to come forward and give of his best for the benefit of all is the line upon which Mr. Doherty has worked; and most people will agree with him that it is the right line.

A Denver Training School.—In connection with the various enterprises which he controls, Mr. Doherty has established a thorough system of technical and business training, and he has what may be called a practical school in all branches in full swing at Denver, where he has control of a combined gas and electricity plant. This is a development of an apprenticeship system which he introduced when he first became a gas manager, in 1896, at Madison, Wis., and it is known as "The School of Gas and Electric Practice." The students for this school are recruited from the engineering colleges of the country, and they generally enter between the ages of 21 and 22. It is from this school that Mr. Doherty reckons to feed the technical and business staffs of his various undertakings. While studying they are also working in the Denver plants, and are paid for their work. The heads of departments and sub-departments deliver lectures twice a week, and, in all, there is a staff of 116 instructors. The students are paid a premium for attendance at the lectures, and, *per contra*, they are fined a larger sum than the premium for absence from any cause. They are moved from one department to another as quickly as possible, and after going through all the operating and other branches they are set to work in the "new business department" until drafted to some other works under the control of Mr. Doherty. The rule is to accept in any year not more than two engineer graduates from any individual college, and this year nearly 200 applications were received for entry. Of last year's class more than half have already been drafted to other works, as the expansion of business has necessitated. The course of training extends over a period of two years, and includes instruction in both gas and electricity work.

How New Business is Got.—Mr. Doherty is enthusiastic about the "new business department," which he initiated in Columbus, O., in 1904, and has now carried to a high pitch of perfection at Denver. The idea has since been copied by a large number of companies, and it has proved a great commercial success. Mr. Doherty kindly sketched for us the system as applied at Denver. The city is divided into 14 districts, and each district is in charge of a man designated as the "Company's representative." This man is expected to know all the customers in his district and to have complete knowledge of his territory, including a proper index book of all prospects for new consumption and extension of consumption by old customers. The efficiency of the department is maintained by a system of education and remuneration. Every morning there is a meeting of representatives, at which plans for new business getting are discussed. This applies not only to Denver, but to all the towns in which Mr. Doherty operates. Shorthand notes of these discussions are taken, and forwarded from the various stations to Denver, where the best of the subject matter is published in a daily paper, run by the firm. In this way all the good points brought out are brought quickly to the attention of all the stations concerned. Once a week an evening meeting is held at every station, at which new business problems are discussed and papers on various subjects read. Reports of these meetings are forwarded to Denver, and the valuable parts are published in the "Daily Bulletin." Every 6 months results are dissected, and the representative making a poor showing is released—the word is Mr. Doherty's—and the assistant representative making the best showing is advanced to the position of representative. The "released" man can go back as an assistant representative, if he chooses to do so. When new men are employed, after 2 weeks' trial the least promising are released from further service, and after a further trial of 3 months another weeding-out process takes place. The experience, so far, has been that not more than 4 men out of every 10 are permanently retained. The remuneration depends upon the amount of revenue created in the district—partly paid in salary, but mostly in commission. There are five scales of remuneration, according to the kind of business brought in, or, rather, according to the amount of capital outlay necessary to secure it. For example, if a new gas consuming appliance is placed without calling for an extra pipe or an extra meter, that would be classed as "point five" business, while in the case where an extra meter must be fixed, or an extra pipe laid, the business would be classed as point two or three. The higher the point the higher the commission; so that it is to the interest of the representative to develop business with the existing service plant as much as possible.

The results achieved under this business-getting method have been in some cases little short of astounding. In one case, where Messrs. Doherty & Co. became owners of the property because the former owners had come to the conclusion that they had arrived at saturation point, the business was increased by 50 per cent. in less than 12 months. To achieve these results money has to be freely expended, not only upon the system of canvassing described here, but also in newspaper advertising and in circularizing. But Mr. Doherty is satisfied that it pays in the long run; and he ought to know. What he said could be done with the electric business of London on similar lines must not be repeated in the pages of the *Gas World*—our electrical friends might be grateful, and offended at the same time. What could be done with the gas supply he does not know—he has not yet had an opportunity of studying our methods.

Asked how gas matters generally were progressing in the States, Mr. Doherty said that during the past 5 years progress in gas engineering had been at a rapid rate, not so much in the direction of new things as in the substitution of poor plant for better. Street lighting by gas is not advancing materially, but this is more than made up for by the rapid development of the fuel gas business. All attempts to establish the supply of a special fuel gas have ended in failure, but the use of ordinary gas for all fuel purposes is rapidly developing. Gas for this purpose is generally sold at a lower rate than is charged for gas used for lighting purposes, and a separate meter is used. For instance, where the lighting rate is $1, the cooking rate may be as low as 80 cents. (Mr. Doherty estimates that over 70 per cent. of the total sales of gas in many of the United States cities is used for fuel purposes.) But the modern tendency is towards a uniform price for all purposes, though, mainly on account of the electric light companies having given great attention to variable methods of charge, some gas companies are trying what is called the readiness to serve method of charge—that is to say, a fixed annual charge, and a low rate per 1,000 for the gas consumed. Meter rents are not general, but, instead, there is a minimum charge of 25 cents per month. Monthly collections are the rule—in some cases they are made weekly—but there is no great demand for penny-in-the-slot meters.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 10 cents.

850,148. Acetylene Gas Generator. H. S. Gallup, Waurica, Okla.

850,395. Feed Mechanism for Gas Producers. A. L. Parker, St. Joseph, Mo.

850,457. Proportional Meter. J. C. Anderson, Highland Park, Ills.

850,509. Device for Lighting Gas Lamps. H. K. Wilson, New Bedford, Mass.

850,568. Inverted Burner Gas Lamp. W. De Freitas, New York, assignor to Consolidated Gas Company, New York.
850,569. Regulating Valve for Gas Burners. F. Egge, Bridgeport, Conn.
850,680. Process of Purifying Gas. G. G. Smith, Florence, Italy.
850,752. Regulator for Mantle Firing Flames. H. Heidorn, Hamburg, Germany.
850,852. Gas Range Lighter. J. H. Robuck, Anadarko, Okla.
850,915. Connection for Tapping Mains. P. Eley, Bayonne, N. J.
850,996. Gas and Air Burner. D. Cooley, Galena, Kas.
851,346. Gas Burner. H. A. Darling, Coshocton, O.
951,349. Extraction of Ammonia from Gases. W. Feld, Honningen-on-the-Rhine, Germany.
851,360. Gas Generating Apparatus. W. E. Leonard, Silver Creek, Wash.; assignor of one-half to B. Waddington, Glendive, Mont.
851,486. Gas Burner for Stoves. J. Bennett, Huntington, W. Va.
851,564. Gas Burner Attachment. J. D. Sheehan, Brooklyn, N. Y.
851,569. Extensible Gas Pipe. G. W. Thorn, Chicago, Ills.
051,613. Acetylene Generator. D. Barnard, Los Angeles, Cal.; assignor to Barnard Light and Heat Company, same place.
851,756. Gas Producing and Heat Generating Process. A. E. Johnson, Denver, Col.; assignor to the Johnson Furnace and Engineering Co., Colorado, Springs. Col.
851,772. Acetylene Gas Generator. S. L. Pedersen, Leland, Ills.
851,954. Apparatus for Producing Gas. G. Marconnet, Paris, France.
851,999. Gas Regulator. D. P. Skellinger, Morristown, N. J.
852,066. Acetylene Gas Generator. J. T. Kittredge, Stillwell, I. T.
852,228. Gas Producer. C. L. Huston, Coatesville, Pa.
852,268. Method of Distilling Coal. O. A. Gobbe, Jumet, Belgium.
852,342. Electric Igniter. F. C. Nickel, J. E. Martin and C. E. Blackburn, Jacksonville, Ills.
852,355. Automatic Gas Cut-off. R. K. Stevens, Sidney, Ia.
852, 359. Street Stopcock for Water and Gas Pipes. E. L. Walcott and G. J. Fischer, Quincy, Ills.
852,370. Automatic Safety Burner. N. Wise, New York.
852,425. Gas Governor. F. Ellis, San Francisco, Cal.
852,461. Automatic Water-Feed for Acetylene Gas Generators. H. G. Scott, Sydney, New South Wales, Australia.
852,516. Gas Producer. C. H. Morgan and A. J. Gifford, Worcester, Mass.; said Gifford assignor to said Morgan.
852,538. Burner for Gas Lamps. E. E. Billow, Chicago, Ills.
852,620. Acetylene Gas Machine. J. R. Ricketts, Fort Worth, Tex.; assignor to H. G. Thomas.
852,679. Gas Log. V. I. Richards, East Orange, N. J.
852,698. Gas-Heated Boiler. R. C. Bishop, Christchurch. New Zealand.
852,930. Process of Generating Gas. J. R. Coutts, Toronto, Canada; assignor of one-half to C. A. Eaton, Cleveland, O.
852,957 and 852,958. Gas Producer. W. B. Hughes, Cleveland, O.
853,021. Gas Burner. J. L. Maloney and E. S. Springer, Leavenworth, Kas.
853,053. Safety Gas Cock on Valve. E. R. Bennett and M. I. Ekern, Flandreau, S. D.
853,125. Carbide-Feed for Acetylene Gas Generators. N. D. Shaffer and J. S. Benton, Johnstown, Pa.
853,400. Acetylene Gas Generator. G. W. Dayton, King City, Cal.
853,420. Device for Charging Furnaces, Gas Generators, etc. H. Rehmann, Mulheim-on-Ruhr, Germany.
853,637. Device for Recording the Reading of Meters. G. E. Hawkins, Columbus, O.
853,653. Gasifier. M. Stewart, Detroit, Mich.
853,654. Gas Burner. S. Stewart, Newark, N. J.
853,746. Acetylene Gas Generator. F. E. Stover, Chattanooga, Tenn.; assignor to the G. R. Lynch Mfg. Co., same place.
853,807. Acetylene Gas Generator. H. G. Leisenring, Wayne, Neb.
854,027. Gas Lamp. R. E. Bruckner, Mount Vernon, N.Y.; assignor to the Commercial Acetylene Co., New York.
854,177. Electric Gas Lighter. E. H. Pryce, Yonkers, N. Y.
854,202. Gas Stove Attachment. E. Effert, Phila., Pa.
854,228. Process of Generating Producer Gas. M. F. Mangelsdorff, New York.
854,696. Apparatus for Analyzing Gases. W. Jones, New York; assignor to the Jones-Julia Mfg. Co., same place.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Now that the United Gas Improvement Company is secure in its leasehold of the Philadelphia city gas works for another long term, it has arranged to expend $2,000,000 in betterments thereon. The main improvements determined upon at this time are: Two new holders in West Philadelphia, each of 3 millions capacity, and a 30-inch leading main from the Point Breeze generating station to the holder station at Ninth and Morris streets.

A CORRESPONDENT in Pueblo, Col., writing to us under date of the 11th inst., incloses the following: "The Pueblo Gas and Fuel Company celebrated its removal to the Company's new and handsome office quarters, 514 Main street, yesterday evening, by giving an 'opening' and 'house warming,' to its patrons and the public generally. The new house was brilliantly illuminated by almost numberless gas lights, and the rooms were tastefully decorated for the inspection of the guests—there were at least 1,200 of such present. Fruit punch from an immense silver bowl was dispensed and proved very refreshing to the visitors, who made a close inspection of the well arranged offices aud an examination of the gas ranges at work in the modernly-equipped kitchen, which was in full blast for demonstration purposes. Near the entrance was a very attractive display of illumination from several portable lights on small tables, which were on the outside, and above the archway at the door was a row of 20 lights. The offices are perfect in every respect."

THE New Light, Heat and Power Company, of Newark, N. Y., has been sold to Messrs. Milldram & Lathrop, of Boston, Mass., the Gas and Electric Development Company, of Philadelphia, acting as the transfer agent. It is possible that the plants will be extended, so that the Company's business may be increased.

THE Mansfield (O.) Gas Light Company has given to the authorities due and formal notice that it has accepted the provisions of the franchises recently passed by the Municipal Council.

THE following clipping from a recent issue of the Milwaukee *Free Press*, explains itself: "On July 22d the employees of the Milwaukee Gas Light Company received their annual dividend, in the shape of a payment equal to 10 per cent. of their wages for the last 6 months. Last year the bonus was only 6 per cent. The Company regards its employees as vital factors in its success for the last few years, and their work has been such in the last year that the increased percentage was given them. The only condition attached to the gifts was the same as in previous years: That employees must have been in the Company's service for a year and regularly employed during the period for which the bonus was given. Every employee of the Company, the executive officers excepted, shared in the dividend. 'No more loyal force of employees can be found in the service of any public service corporation,' said General Manager S. J. Glass, 'than those of the Milwaukee Gas Light Company. All of them feel a genuine interest in the Company s welfare. No matter in what capacity they are working, they always are seeking for additional business for the Company and looking for means of bettering the service. This, of course, means increased returns, which works to the advantage of the consumer. The recent reduction in the price of gas, for instance, was made possible by the increase in its use in Milwaukee. The principal cause of this increase was the fact that the people of Milwaukee have thorough confidence in our system of attending to their needs. This kind of service, of course, would be out of the question without the loyal co-operation of our employees.'"

"F. J. F.," writing from Topeka, Kas., under date of the 16th inst., says: "Attorney-General Jackson, in an opinion given at the request of John B. Thorne, Attorney of Johnson county, has denied the right of gas companies to charge or require meter deposits as guarantees that their gas accounts shall be paid. Quoting from the opinion: 'A gas company may make reasonable rules and regulations and a rule requiring a deposit by its customers to secure prompt payment of accounts due is not unreasonable, if the amount required itself be a reasonable sum; but such a rule must be applicable to all of its customers alike. And a rule discriminating between poor people, who of necessity reside in rented property and others who are more fortunately situated so as to be able to own their property, is so repugnant to American notions of republican equality that no court, in my

judgment, would tolerate it.' Here are cited certain opinions as precedents, after which Justice Jackson said: 'In view of the foregoing, I am of the opinion that the regulation which you describe is an unlawful discrimination between the customers of such Gas Company, and that the persons so discriminated against have actions in mandamus to compel the Company to furnish them with gas on equal terms with the rest of patrons, and have actions for damages for the Company's refusal so to do; and that persistence in such exacting tyrannous and oppressive methods by the Gas Company would warrant the institution of an action by the State on your relation as County Attorney to forfeit its charter and franchises.'"

THE Milwaukee Council Committee on Judiciary has recommended that the place of City Gas Inspector be continued, despite the provision in the Public Utilities Act declaring that place or position abolished.

MR. WILLIAM B. MILLER, formerly Superintendent of the Birmingham (Ala.) Railway, Light and Power Company, has commenced construction work on the plant of the new Tri-City Gas Company. It looks that the Higgins-Miller syndicate has a good thing in this operation.

THE work of increasing the generating system of the West End plant of the Bridgeport (Conn.) Gas Light Company will be completed by the 20th prox. That the Company means to take advantage of every opportunity for extending its business is completely shown from the fact that this year it will have placed no less than 20 miles of distributing mains.

THE new net rate (it became operative the 1st inst.) at Waterbury, for all account and use, is $1.10 per 1,000 cubic feet.

ON the 7th prox. the H. Mueller Manufacturing Company, of Decatur, Ills., will celebrate the Golden Anniversary of the founding of its business, the celebration to be in the nature of a picnic on the handsome grounds of Chatauqua Park, Mechanicsburg, Ills. Later on we hope to give the details of the pleasuring.

CERTIFICATES of incorporation have been filed with the State Department of Delaware, giving existence to the Automatic Gas Light Company, with headquarters in Baltimore, Md. The concern is capitalized in $150,000, and it is formed "to purchase, acquire, take, hold and improve by patent devices gas burners and kindred appliances for the lighting thereof."

"M. E. B." writing from Lynn, Mass., under date of the 17th inst., incloses the following: "The inspectors of the Lynn Gas and Electric Company are to appear in handsome uniforms, having the initials of the Company on the collar of the coat and also upon the front of the cap. Mr. Prichard resorted to this course in the belief that the plan would assist in putting an end to the all too frequent smashing and looting of the prepayment gas meters. The uniforms are of dull gray with black trimmings and the inevitable brass buttons. The coat a 4-button, straight sack, with black braid running around the sleeves about 4 inches from the end and the initials of the Company worked in gold on the collar. The trousers have an inch-wide, black stripe, while the cap, which is of gray cloth with black visor, has an inch-wide black band with the initials of the Company worked in gold on the front. The meter readers will have a black band around their hats with the initials of the Company worked in gold letters."

ON August 9th the Coffin Valve Company was organized in Augusta, Me., for the purposes of manufacturing and dealing in water, gas and steam valves. It is capitalized in $250,000, and its officers are: President, E. J. Pike, of Augusta; Treasurer, A. M. Currier, same place.

ON the 10th inst., Judge Creighton, in Circuit Court, ratified the action of Charles and William Ridgely, Trustees and Executors of the estate of Mr. N. H. Ridgely, in their disposition of the Clinton (Ills.) gas works.

MR. J. T. LYNN and associates have about completed the betterment system planned for the Quincy (Ills.) Gas and Electric Company. The old holder has been put in good condition, and the new one of 500,000 cubic feet capacity completed puts an end to any anxiety over the storage question. The old leading main (it was a 10-inch one) has been replaced by a 20-inch.

THE San Antonio (Tex.) Gas and Electric Company has sold its property on West Houston street on which was located the old gas plant constructed 30 years ago by the Messrs. Lockwood. The elder Mr. Lockwood, now dead, told the writer that the plot cost then $900, in 1877, and their successors, it is said, were paid $55,000 for it.

WE fail to note that the Bemis-Adams-Marks scientific expert combination are loudly heralding the fact that the Metropolitan Gas Light Company, of London, England, has been obliged to increase its selling rate in the sum of 6 cents per 1,000 cubic feet. This, too, for a gas of 14-candle power. The increase was absolutely necessary, and was brought about by the high price of gas coal.

IT is guaranteed by the projectors that the gas plant for Mount Carmel, Ills., will be in working order within a twelvemonth.

THE office quarters of the Portland (Ore.) Gas Company have been removed to the modern office building recently completed at the junction of Sixth and Oak streets.

THE shareholders of the York (Pa.) Gas Company have sanctioned the recommendation of the Directors that the capital stock of the concern be increased from $800,000 to $1,000,000. It is proposed to use the proceeds in the placing of a high pressure system of distribution, taking in several nearby towns.

HERE is what a French writer recently said respecting the lighting of Pekin: "Eighty thousand taels ($50,400) is assigned each year for street lighting purposes; of which the official in charge takes $40,000 as his share, and gives the rest to a subordinate. This latter hands over $20,000 to his inferior, and so on, until the original sum is reduced to a few coppers in cash, given to a coolie to buy oil and a wick; these are placed on a plate on the ground, a beggar comes along and drinks the oil; and such is the lighting of Pekin."

THE public lighting department of Holyoke, Mass., under the capable direction of Mr. W. H. Snow, is booming. From the returns for last July, compared with those of a year ago, the gas output shows an increase of 26 per cent. This is the largest percentage gain reported in the instance of the gas output in Holyoke since 1872.

A FEMININE resident of Orange, N. J.—her name is Alice Strawway—recently made up her mind to leave her husband, for better or for worse. She left her spouse a "few lines" of explanation and admonition, the closing line of which was: "Please pay your gas bill, attached."

GAS was supplied to the residents of Owatonna, Minn., the first week of this month.

THE new gas plant at Canastota, N. Y., is in working order and a good business in ranges is reported. About 100 consumers were on the line at the starting.

THE Board of Gas and Electric Light Commissioners has vetoed or denied the application of the Amherst Electric Light Company to distribute and sell electric currents for any purpose in the town of Easthampton, Mass.

THE betterments on the plant of the Mankato (Minn.) Gas and Electric Company will involve an expenditure of $20,000.

COMMISSIONER CROWLEY'S official tests continue to show that the gas supplied in Omaha, Neb., is well above the statutory requirement.

MR. L. T. PALMER, Vice-President and General Manager of the Niagara Light, Heat and Power Company, Tonawanda, N. Y., has been elected President of the Lawrence Stove and Manufacturing Company, of Buffalo, N. Y., which incorporation succeeds to the Lawrence Stove Company of that city. The latter concern carried on a very successful manufacturing business in gas heating stoves, hot plates and the like, and the present Company was organized to carry on the trading on a very much larger scale. It is proposed to engage extensively in the construction of gas ranges, along lines that Mr. Palmer says are quite original. The other officers are: President, Mr. Frank L. Grady; Sec.-Treas., Mr. C. F. Grady. The Company is capitalized in $70,000, and a Committee is now engaged in selecting a site in Buffalo whereon it is proposed to construct an up-to-date factory in every respect.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance.
Single copies, 10 cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, AUGUST 26, 1907.

The Market for Gas Securities.

Still there is no market, but it looks that bottom has been reached. Consolidated managed to cross 104 for a time yesterday, and today (Friday) the opening was 103½ to 104½. The crack this week did not affect Brooklyn Union to any extent, but everyone knows that these shares "got theirs" quite a while back.

Peoples, of Chicago, is quoted at 85½ to 86½, and Massachusetts gas is 51 to 51½. Some rare bargains are on the market, in the shape of city gas bonds. Just think of Standard first mortgage 5's, at 100 to 105. With others in like ratio!

Gas Stocks.

Quotations by George W. Cless, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 26.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	103¼	104¼
Central Union Gas Co.—				
1st 5's, due 1972, J & J	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	225
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	90	93
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	..	97	101
Standard	5,000,000	100	100	105
Preferred	5,000,000	100	165	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	100	110
1st Con. 5's, due 1948, M. & N	15,000,000		100¼	102
Yonkers	999,650	500	120	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	95½	96½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,026,500	100	107¾	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,000,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	980,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	351,000	1,000	75	80
" Inc. 5's	15,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,550,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	250,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	56	58
Massachusetts Gas Companies of Boston	25,000,000	100	51	51½
Preferred	25,000,000	100	80½	81
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	85½	86½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	30,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105½
San Francisco, Cal.	15,800,000	00	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,485,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	375	380
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	200	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 377
Baxter & Young, Detroit, Mich 387
B. E. Cholliar, St. Louis, Mo 380
Cruse-Kemper Co. Philadelphia, Pa 376
Davis & Farnum Mfg. Co., Waltham, Mass 388
Economical Gas Apparatus Construc'n Co., Toronto, Ont 387
Frank D. Moses, Trenton, N. J 390
Frederic Egner, Norfolk, Va 392
H. M. Byllesby & Co., Chicago, Ills 388
Humphreys & Glasgow, New York City 388
Isbell-Porter Co., Newark, N. J 376
Kerr Murray Mfg. Co., Fort Wayne, Ind 389
Practical Gas Construction Co., North Chicago, Ills 388
The Gas Machinery Co., Cleveland, O 372
The Jeffrey Manufacturing Co., Columbus, O 386
United Gas Improvement Co., Philadelphia, Pa 383
Western Gas Construction Co., Fort Wayne, Ind 352

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 377
Bartlett, Hayward & Co., Baltimore, Md 389
Baxter & Young, Detroit, Mich 387
Connelly Iron Sponge & Governor Co., New York City 385
Continental Iron Works, Brooklyn, N. Y 390
Cruse-Kemper Co., Philadelphia, Pa 376
Davis & Farnum Mfg. Co., Waltham, Mass 388
Delly & Fowler, Philadelphia, Pa 392
Economical Gas Apparatus Construc'n Co., Toronto, Ont. 387
Frank D. Moses, Trenton, N. J 390
Humphreys & Glasgow, New York City 388
Isbell-Porter Company, New York City 376
Kerr Murray Mfg. Co., Fort Wayne, Ind 389
Lloyd Construction Co., Detroit, Mich 378
Logan Iron Works, Brooklyn, N. Y 392
Quintard Iron Works, New York City 388
R. D. Wood & Co., Philadelphia, Pa 390
Riter-Conley Mfg. Co., Pittsburgh, Pa 391
Stacey Mfg. Co., Cincinnati, O 391
The Gas Machinery Co., Cleveland, O 372
The Jeffrey Manufacturing Co., Columbus, O 386
United Gas Improvement Co., Philadelphia, Pa 383
Western Gas Construction Co., Fort Wayne, Ind 352

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 389
B. E. Cholliar, St. Louis, Mo 380
Economical Gas Apparatus Construc'n Co, Toron'o, Ont 387
Humphreys & Glasgow, New York City 388
Semet-Solvay Co., Syracuse, N. Y 386
The Gas Machinery Co., Cleveland, O 372
United Gas Improvement Co., Philadelph'a, Pa 383
Western Gas Construction Co., Fort Wayne, Ind 352

SCRUBBERS AND CONDENSERS

Continental Iron Works, Brooklyn, N. Y 390
Cruse-Kemper Co., Philadelphia, Pa 376
Davis & Farnum Mfg. Co., Waltham, Mass 388
Economical Gas Apparatus Construc. Co., Toronto, Ont 387
Isbell-Porter Co., Newark, N. J 376
Kerr Murray Mfg. Co., Fort Wayne, Ind 389
Logan Iron Works, Brooklyn, N. Y 392
R. D. Wood & Co., Philadelphia, Pa 390
Riter-Conley Mfg. Co., Pittsburgh, Pa 391
Stacey Mfg. Co., Cincinnati, O 391
The Gas Machinery Co., Cleveland, O 372
Western Gas Construction Co., Fort Wayne, Ind 352

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc. Co., Toronto, Ont. 387
R. D. Wood & Co., Philadelphia, Pa 390

TAR AND CARBONIC ACID EXTRACTON.

Economical Gas Apparatus Construc'n Co., Toronto, Ont 387
Isbell-Porter Co., Newark, N. J 376
Kerr Murray Mfg. Co., Fort Wayne, Ind 389
Stacey Mfg. Co., Cincinnati, O 391
The Gas Machinery Co., Cleveland, O 372
Western Gas Construction Co., Fort Wayne, Ind 352

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich 370
The Gas Machinery Co., Cleveland, O 372
Western Gas Construction Co., Fort Wayne, Ind 352

GAS METERS.

American Meter Co., New York and Philadelphia 395
Detroit Meter Company, Detroit, Mich 351
D. McDonald & Co., Albany, N. Y 393
Helme & McIlhenny, Philadelphia, Pa 395
John J. Griffin & Co., Philadelphia, Pa 396
Keystone Meter Co., Royersford, Pa 394
Maryland Meter and Mfg. Co., Baltimore, Md 394
Metric Metal Co., Erie, Pa 395
Nathaniel Tufts Meter Co., Boston, Mass 394
New York Improved Meter Co., New York City 394
Pittsburg Meter Co., East Pittsburg, Pa 391
Rotary Meter Co., New York City 374
United States Meter Co., Brooklyn, N. Y 375

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 395
D. McDonald & Co., Albany, N. Y..... 393
Helme & McIlhenny, Philadelphia, Pa..... 395
John J. Griffin & Co., Philadelphia, Pa..... 396
Keystone Meter Co., Royersford, Pa..... 394
Nathaniel Tufts Meter Co., Boston, Mass..... 394
New York Improved Meter Co., New York City..... 394
Pittsburg Meter Co., East Pittsburg, Pa. 393

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City..... 394

WATER METERS.

Pittsburg Meter Co., East Pittsburg, Pa..... 393

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Donaldson Iron Co., Emaus, Pa..... 380
Economical Gas Apparatus Construc'n Co., Toronto, Ont. 387
R. D. Wood & Co., Philadelphia, Pa..... 390
Warren Foundry and Machine Co., New York City..... 380

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 386
Perkins Co., New York City..... 386
Westmoreland Gas Coal Co., Philadelphia, Pa..... 387

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 374

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City..... 380

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 346

GAS TAPPING MACHINES.

George Light, Dayton, O..... 330
H. Mueller Manufacturing Co., Decatur, Ills..... 370

CANNEL COALS.

Perkins & Co., New York City..... 386

STOKING MACHINERY.

G. A. Bronder, New York City..... 385

CONVEYORS.

Cruse-Kemper Co., Philadelphia, Pa..... 376
C. W. Hunt Company, New York City..... 377
Economical Gas Apparatus Construc'n Co., Toronto, Ont 387
G. A. Bronder, New York City..... 385
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
The Gas Machinery Co., Cleveland, O..... 372
The Jeffrey Manufacturing Co., Columbus, O..... 336
Western Gas Construction Co., Fort Wayne, Ind..... 352

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
Stacey Mfg. Co., Cincinnati, O..... 391

GAS ENRICHERS.

Standard Oil Co., New York City..... 343

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 387
The Jeffrey Manufacturing Co., Columbus, O..... 336

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 370

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 370

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 377

GAS GOVERNORS.

Chaplin-Fulton Mfg. Co., Pittsburgh, Pa..... 380
Connelly Iron Sponge & Governor Co., New York City. 375
Isbell Porter Co., Newark, N. J..... 376
Pittsburg Meter Co., East Pittsburg, Pa..... 393
R. D. Wood & Co., Philadelphia, Pa..... 390
Reynolds Gas Regulator Co., Anderson, Ind..... 377

FUEL ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N. Y..... 377

CEMENTS.

C. L. Gerould, Pittsburgh, Pa..... 390

RETORTS AND FIREBRICKS.

Baltimore Retort and Firebrick Co., Baltimore, Md. .. 384
Gas Bench Construction Co., St. Louis, Mo. 384
Henry Maurer & Son, New York City..... 377
James Gardner, Jr., Co., Bolivar, Pa..... 386
J. H. Gautier & Co., Jersey City, N. J..... 384
Laclede-Christy Clay Products Co., St. Louis, Mo.. .. 373
Missouri Firebrick Co., St. Louis, Mo..... 384
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 375

INCLINED RETORTS.

Baltimore Retort and Firebrick Co., Baltimore, Md..... 384
Gas Bench Construction Co., St. Louis, Mo..... 384
Laclede-Christy Clay Products Co., St. Louis, Mo. 373
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 375

VERTICAL SETS.

Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 385
Gas Bench Construction Co., St. Louis, Mo..... 384
Laclede-Christy Clay Products Co., St. Louis, Mo..... 373
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 375

REGENERATIVE FURNACES.

Baltimore Retort and Firebrick Co., Baltimore, Md..... 384
Bartlett, Hayward & Co., Baltimore, Md 389
Gas Bench Construction Co., St. Louis, Mo..... 384
J. H. Gautier & Co., Jersey City, N. J..... 384
Laclede-Christy Clay Products Co., St. Louis, Mo..... 373
Missouri Firebrick Co., St. Louis, Mo..... 384
Parker-Russell Mining and Mfg. Co., St. Louis Mo..... 375

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N. Y..... 390
Davis & Farnum Mfg Co., Waltham, Mass..... 388
Isbell-Porter Co., Newark, N. J..... 376
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
Logan Iron Works, Brooklyn, N. Y..... 392
R. D. Wood & Co., Philadelphia, Pa..... 390
Stacey Mfg. Co., Cincinnati, O..... 391
The Gas Machinery Co., Cleveland, O..... 372
Western Gas Construction Co., Fort Wayne, Ind..... 352

INCANDESCENT GAS LAMPS.

General Gas Light Co., Kalamazoo, Mich..... 379
Geo. G. Ramsdell, New York City..... 374
Welsbach Company, Gloucester, N. J..... 382

BURNERS.

Wm. M. Crane Co., New York City..... 374

STREET LAMPS.

Thos. T. W. Miner, New York City..... 380
Welsbach Street Lighting Co., New York and Phila... 382

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City.. 385
Cruse-Kemper Co., Philadelphia, Pa..... 376
Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Isbell-Porter Co., Newark, N. J..... 376
Kerr Murray Mfg Co., Fort Wayne, Ind..... 389
R. D. Wood & Co., Philadelphia, Pa..... 390
Stacey Mfg. Co., Cincinnati, O..... 391
Western Gas Construction Co., Fort Wayne, Ind..... 352

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City.. 385

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 390
Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Economical Gas Apparatus Construc'n Co, Toronto, Ont 387
Isbell-Porter Co., Newark, N. J..... 376
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
Ludlow Valve Manufacturing Co., Troy, N. Y..... 377
R. D. Wood & Co., Philadelphia, Pa..... 390
Stacey Mfg. Co., Cincinnati, O..... 391
The P. H. & F. M. Roots Co., Connersville, Ind 379
Western Gas Construction Co., Fort Wayne, Ind..... 352

(*Continued on page 370.*)

Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.
EMPIRE GAS IMPROVEMENT & CONSTRUCTION COMPANY,
1628-tf 49 Wall Street, New York.

Position Wanted.

A Capable Manager and Superintendent,

Now employed, desires a position as manager or superintendent of gas, or combined gas and electric plants, in city of 15,000 to 25,000 population. Successful record. Southern or Middle States location preferred.
Address, "P. T. A.,"
1641-tf Care this Journal.

POSITION WANTED.

Successful gas and electric manager is open for position. Can furnish best of references.
Address, "EXPERIENCE,"
1675-tf Care this Journal

Position Wanted

By young man with 9 years' practical experience in combined gas and electric plants. Can work in any capacity. Can furnish the best of references. Southwestern States preferred.
1681-2 Address, "TOM," care this Journal

WANTED.

A large concern operating various gas and electric properties in the Southwest has opening for an energetic solicitor.
Address, "B. H. J.,"
16-1-2 Care this Journal.

WANTED,

An All-Round Man,

Who can set meters, ranges, etc., and who has a general knowledge of pipe laying and gasfitting. All the better it will be if to the foregoing the applicant possesses some knowledge of gas manufacture and distribution. A permanent place at a good salary awaits such a man.
Address, "D. F. G.,"
16-tf-3 Care this Journal.

WANTED AT ONCE,

Competent Gas Office Man,

To handle gas and electric consumers' ledgers for up-to-date company. State age, experience, etc., also salary expected.
Address,
UNION LIGHT, HEAT & POWER CO.,
1677-tf FARGO, N. D.

GAS BOOKS WANTED.

My library of gas books and subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In re-establishing this library, which will find an ultimate home with a gas association or educational institution, I am desirous of securing all available gas literature printed in the English language, including technical works, reports, pamphlets, etc., and will purchase such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating condition of volume and net price desired, carriage included. L. P. LOWE,
1681-2m 1214 Polk St., San Francisco, Cal., U. S. A.

WANTED,

SECOND-HAND NO. 6 OR NO. 7 ROOTS' EXHAUSTER.

Address,
JACKSONVILLE GAS COMPANY,
1678-4 JACKSONVILLE, FLA.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1.

For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, - - - - New York City.

GAS AND ELECTRIC PROPERTIES.

M. J. LOXLEY COMPANY,

BANKERS,

Land Title Building, Philadelphia, Pa.

(Concluded from page 369.)

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City.. 385
Connersville Blower Co., Connersville, Ind..... 372
Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Isbell-Porter Company, Newark, N. J..... 376
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
The P. H. & F. M. Roots Co., Connersville, Ind..... 379

PURIFIER AND SCRUBBER TRAYS.

Cabot Mfg. Co., Hoboken, N. J. 387
Western Gas Construction Co., Fort Wayne, Ind..... 352

GAS STOVES.

American Meter Co., New York and Philadelphia..... 395
Keystone Meter Co., Royersford, Pa..... 394
Maryland Meter & Manufacturing Co., Baltimore, Md.. 394
Nathaniel Tufts Meter Co., Boston, Mass..... 394
Stamford Gas Stove Co., Stamford, Conn..... 370

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 375

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 390

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 389
Continental Iron Works, Brooklyn, N. Y..... 390
Cruse-Kemper Co., Philadelphia, Pa. 376
Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Deily & Fowler, Philadelphia, Pa..... 392
Economical Gas Apparatus Construc'n Co., Toronto, Ont 387
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 389
Logan Iron Works, Brooklyn, N. Y..... 392
R. D. Wood & Co., Philadelphia, Pa..... 390
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 391
Stacey Mfg. Co., Cincinnati, O..... 391
Western Gas Construction Co., Fort Wayne, Ind..... 352

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 388
Stacey Mfg. Co., Cincinnati, O..... 391
Western Gas Construction Co., Fort Wayne, Ind..... 352

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 387

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS. • Detroit, Mich.

JOIN THE PROCESSION
—AND SELL—
STAMFORD ODORLESS HEATERS,
ACKNOWLEDGED THE STANDARD.
MADE IN A NUMBER OF STYLES AND SIZES.
WRITE TO-DAY FOR OUR NEW HEATER CATALOG.
THE STAMFORD GAS STOVE CO.,
STAMFORD, CONN.

Century Pattern.

Molded Lead Ring Gasket.

MUELLER IRON SERVICE CLAMPS.
Used with the Mueller Patent Molded Lead Ring Gaskets, Mueller Galvanized Service Clamps, made of the best malleable iron, form a pipe connection that will not leak.
THEY HAVE GOT THE GRIP
That holds them to the pipe in immovable position, the tapping surface is of extra thickness, allowing full length threads, and the ribs cast on the clamp give added strength. Straps are made of the best soft steel and accurately threaded. Mueller Service Clamps are made in Century (single strap) and Improved National (double strap) patterns. Either black or galvanized.
Write for prices and literature.
MUELLER
H. MUELLER MFG. CO.
Works and General Offices, DECATUR, ILL., U. S. A. West Cerro Gordo St.
Eastern Division, NEW YORK, N. Y., U. S. A. 254-258 Canal St. (cor. Lafayette).

OFFICERS:
E. C. BROWN, President. B. H. SPANGENBERG, Gen'l Mgr. and Eng'r.
L. J. MONTGOMERY, Sec'y and Treas. SIDNEY A. REEVE, M.E., Consulting Eng'r.

DIRECTORS:
E. C. BROWN, IRA C. COPLEY, HENRY L. DOHERTY, GEO. D. ROPER, THOMAS G. MARSH, M.E., Dr. F. SCHNIEWIND, FREDERICK H. SHELTON.

EUROPEAN CONNECTIONS:
The Rotary Meter Co. (1905) Ltd., Manchester, England.
Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, Paris, France.

ROTARY STATION METERS

Now in use in the United States and Europe

MEASURING A DAILY MAKE OF MORE THAN 300,000,000 CUBIC FEET.

400 Installations to date with capacities from 500,000 Cubic Feet per Hour down to 5,000 Cubic Feet per Hour.

30,000 cu. ft. per hour.
12-inch connections.
40-inch face to face flanges.
50 inches floor to c. of dial.
FOR NORWICH, N. Y.

45,000 cu. ft. per hour.
16-inch connections.
52-inch face to face flanges.
61 inches floor to c. of dial.
FOR EL PASO, TEXAS.

60,000 cu. ft. per hour.
20-inch connections.
58-inch face to face flanges.
70 inches floor to c. of dial.
FOR CHESTER, PA.

The above engraving was reproduced from a photograph taken recently when these three meters were on the floor of our factory ready for shipment. Upwards of 50 Rotary Station Meters have at this date been installed or contracted for by gas companies located in 17 States of this country, and several in Canada.

ROTARY METER COMPANY

One-half the cost—One-tenth the space of old style wet meters.

When in need of Station Meters, write

ROTARY METER COMPANY,
280 Broadway,
NEW YORK.

Send for Catalog.

P. PLANTINGA, President. W. E. STEINWEDELL, Secretary.

THE GAS MACHINERY CO.,

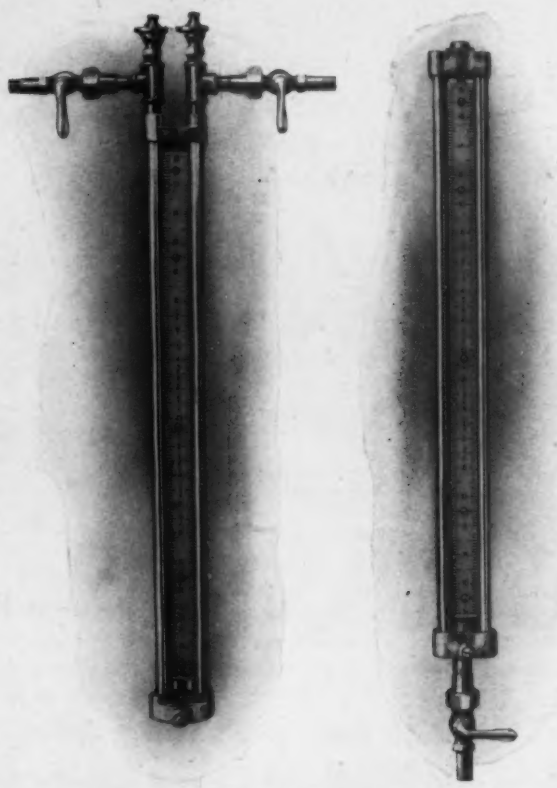
Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - - 56 PINE STREET.

COAL AND WATER GAS APPARATUS,
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS, WASHERS, PURIFIERS,
VALVES, CONNECTIONS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.

PACIFIC COAST AGENTS: Hallidie Machinery Co., Seattle, Wash.



DIFFERENTIAL AND OPEN PRESSURE GAUGES.

THE GAS MACHINERY CO.
CLEVELAND, OHIO.

LACLEDE-CHRISTY CLAY PRODUCTS CO.,

LACLEDE PLANT:
MANCHESTER AND
SULPHUR AVES.

ST. LOUIS, MO.

SUCCESSOR TO

CHRISTY PLANT:
MORGANFORD ROAD &
GRAVOIS AVE.

LACLEDE FIREBRICK MFG. CO. and CHRISTY FIRECLAY CO.

ENGINEERS AND BUILDERS OF GAS BENCHES AND GLASS PLANTS.

OUR OWN DESIGNS INCORPORATED IN OUR BENCHES OF HORIZONTAL, INCLINED AND VERTICAL RETORTS.

SPECIAL DESIGNS FOR GLASS FURNACES TO SUIT SPECIAL CONDITIONS.

LININGS FOR

LIME KILNS AND CUPOLAS,
REFUSE BURNERS, BRASS FURNACES,
WATER GAS SETS, HEATING FURNACES,
BAUXITE OR BASIC HOT ZONES,
ROTARY CEMENT KILNS.

LOCOMOTIVE TILE,
BOILER SETTINGS,
TANK FURNACE BLOCKS,
SEWER PIPE AND FITTINGS,
GAS BENCH SETTINGS,
GLASS HOUSE REFRACTORIES,
FLUE LININGS, CHIMNEY TOPS,
MILLED CLAYS,

FIREPROOFING,
GRATE SETTINGS,
KILN FLOOR TILE,
VITRIFIED CLAY PRODUCTS,
GAS RETORTS, CARBON TILE,
RETORT PATCHING CEMENT,
WASHED POT CLAYS,
FURNACE AND CRUDE CLAYS.

CLAY PRODUCTS OF EVERY DESCRIPTION.

WHAT UNCLE SAM'S EXPERTS SAY OF BRAY BURNERS.

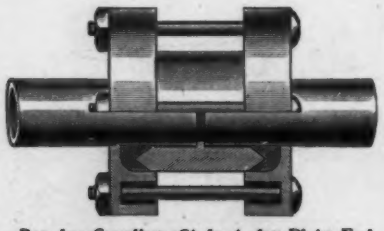
The United States Government Inspector of Gas,

in an Annual Official Report, has stated: "In particular, was attention given to inspection of **BRAY'S "Special" Slit-Union** and **"Special" Union-Jet Burners.** The "Special" Burners manufactured by **Geo. Bray & Co.** compare favorably with any yet inspected by this office; **they are well made** and no doubt will prove very durable in practical use. The result of test with **BRAY'S Standard Slit-Union was highly satisfactory;** it will yield the maximum candle power obtainable from a cubic foot of gas."

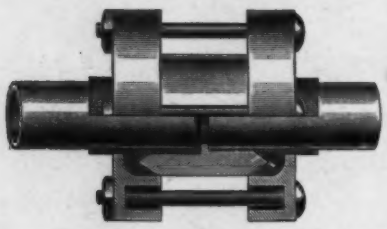
A Postal Brings our Blue Book.

W. M. CRANE COMPANY,

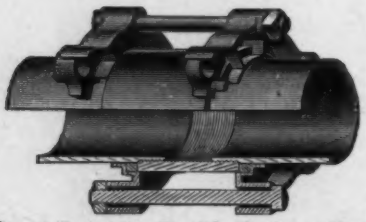
WE MAKE GAS APPLIANCES OF ALL KINDS. SOLE AGENTS FOR THE UNITED STATES AND CANADA.



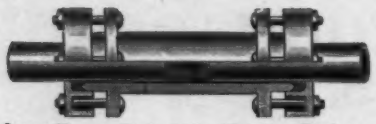
Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.



Clamp, Style 4, for Repairing Leaks on Screw Collar.



Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER MANUFACTURING CO.,

SUCCESSORS TO

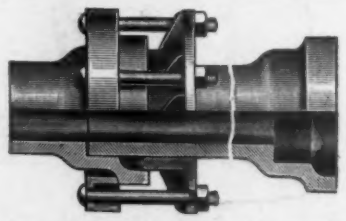
S. R. DRESSER,

BRADFORD, PA., U. S. A.,

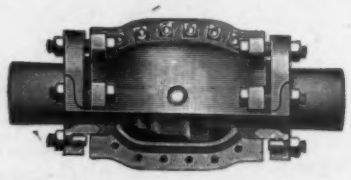
Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

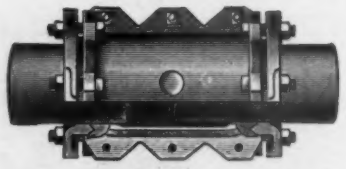
STATE REQUIREMENTS AND SEND FOR CATALOGUE.



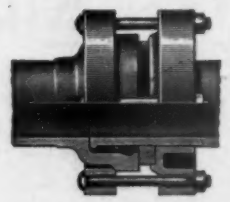
Coupling, Style 9, for Special Style Cast Iron Pipe.



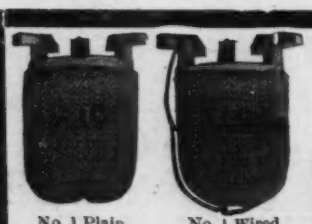
Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



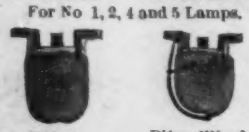
Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.



No. 1 Plain. No. 1 Wired
For No 1, 2, 4 and 5 Lamps.



Bijou. Bijou Wired.
For No. 3 (Bijou) Lamp.

"Rico" Mantles.

Ramsdell

Our Mantles are the Standard Inverted Mantles, just as the RAMSDELL is the Standard Inverted Lamp. They are manufactured especially for the Ramsdell Lamps, being made of double woven Ramie and bearing our Trade Mark "RICO." Being made on our patented Mantle Ring, a firm hold is obtained on the porcelain cone, which prevents the mantle being jarred off the holder. This is an important feature of the "Rico" Mantles, and is one of the points which makes them the best mantles produced.

We have the exclusive control for the United States and Canada of the Farkas patents, covering the WIRE CAGED MANTLES such as are used abroad for Railway Car Lighting. This Mantle has been extensively used by us in the past two years on the Ramsdell Inverted Arcs and on other lamps where they are subjected to unusually severe requirements.

RAMSDELL INVERTED GAS LAMP CO., 530 Broadway, New York.

THE UNITED STATES.

PATENTED MAY 13, 1902.
"Self-Draining Meter."

THE UNITED STATES
Self-Draining Meter.

NO DUMPING OF METERS TO GET THE WATER OUT.

Saves Over 75 Per Cent. in Cost Annual Repairs.

Prices low. Extra heavy tin used. Demonstrations at our expense. Send for circular.

THE UNITED STATES METER CO., { 229-269 Chestnut St., Brooklyn, N. Y.

PARKER-RUSSELL MINING AND MFG. CO.,

ST. LOUIS, MO.

ST. LOUIS OFFICE: Suite 501-508 Liggett Building, 8th and Chestnut Streets.
NEW YORK OFFICE: 45 Broadway.

GAS RETORT BENCHES, STOKING MACHINERY, STAND-PIPE CLEANER AND STRAIGHT STAND-PIPE SYSTEM.

GAS RETORTS AND FIREBRICK.

We Manufacture Gas Retorts and Settings, Furnace Blocks and Fire Clay Tiles of Every Description.

Benches.--We erect GAS RETORT BENCHES with Horizontal retorts having closed ends up to 10 feet in length, or Through retorts up to 20 feet in length.

Slopers.--Also, SLOPERS on improved lines for Inclined Retorts.

Stoking Machinery.--Sole Agents for U. S. and Canada for the Fiddes-Aldridge Simultaneous Discharging Charger. The "F. A.," or "One-Stroke" Machine. Cost of Carbonizing reduced to minimum. No Dust. Silent. No Waste of Coal. No Injury to Retorts.

Water Gas Linings.--We make a specialty of WATER GAS BLOCKS, and supply brick of superior grade for checkerwork.

Stand-Pipe Cleaner and Straight Stand-Pipe System.--Agents for the sale of the Stand-Pipe Cleaner and Straight Stand-Pipe System of the United Gas Improvement Company.

Retort Houses and Conveying Machinery.--We also build Retort Houses, Coal and Coke Conveying Machinery. Plans, specifications and estimates cheerfully furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE, AS OF ST. LOUIS.

BEST IN THE WORLD.

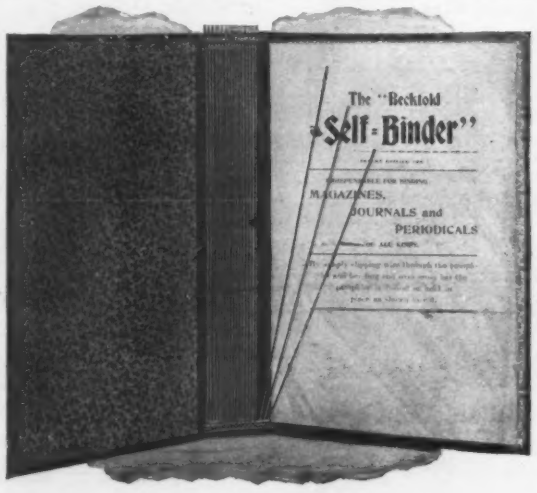
THAT MEANS THE

Humphrey Instantaneous Bath Water Heaters.

They should be used in every home, no matter whether there are other hot water arrangements or not.

Handsome New Catalog No. 9 is Free. Shall we Send it?

HUMPHREY CO.,
Kalamazoo, Mich., U. S. A.



Binder
FOR THE
Journal.
PRICE,
$1.

For Sale by
A. M. CALLENDER & CO.,
42 Pine Street,
New York City.

ARTHUR R. CRUSE. PRESIDENT.
HENRY W. SCATTERGOOD, VICE PRESIDENT & TREASURER.
FRANK FLAVELL, SECRETARY.

CRUSE-KEMPER COMPANY

PHILADELPHIA OFFICES: SUITE 1124 LAND TITLE BUILDING.
WORKS: AMBLER PA.

Manufacturers of

TRIPLE
DOUBLE and
SINGLE-LIFT

Gas Holders

WITH OR WITHOUT
METAL TANKS

Oil and Water Tanks
Purifier Covers
General Plate Metal Work and
Steel Water Towers

PLANS, SPECIFICATIONS AND ESTIMATES
PROMPTLY FURNISHED ON REQUEST

J. S. DeHART, JR., PRESIDENT
A. F. WEHNER, SECRETARY
R. K. WEHNER, TREASURER

ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

BENCH WORK

CHARGING AND
DISCHARGING
MACHINERY

MACKENZIE
EXHAUSTERS

PRIMARY AND
SECONDARY
CONDENSERS
FOR FRESH
OR SALT WATER

MAIN OFFICE AND WORKS
BRIDGE & OGDEN STREETS
NEWARK, N.J.
ESTABLISHED 1865

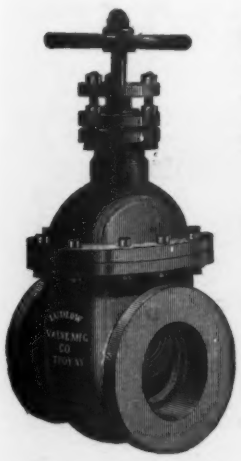
ISBELL VALVES
SPECIALS

TAR
EXTRACTORS

P.&A. TAR EXTRACTORS
FOR WATER GAS

ROTARY AMMONIA
SCRUBBERS

SHAVING
SCRUBBERS
PURIFIERS
STREET GOVERNORS



THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

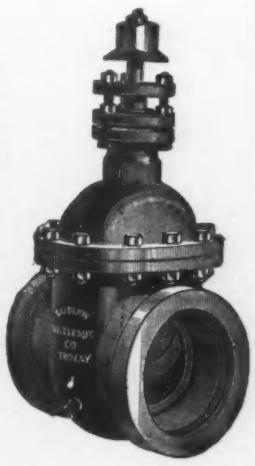
Double and Single Gate Valves, ¼" to 72",

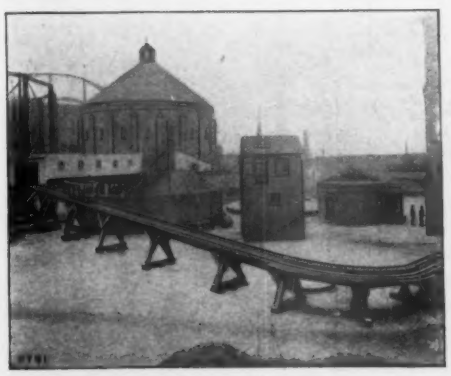
—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.





HUNT CABLE RAILWAYS

For Handling Coal and Coke in Gas Works.

The cost of handling coal and coke by this method is only the expense of loading the cars (one man) and the power to drive the cable. Every inch of ground is available, as the space under the trestles can be utilized for storage, if necessary. These railways are built of different types, to handle any quantity of material, large or small.

If you are interested in the subject, we will take pleasure in sending you photographs of some of the plants we have installed upon receipt of your card, and will give such information as is in our power if you will let us know your requirements.

C. W. HUNT CO., West New Brighton, N. Y. 45 Broadway, New York.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at

No. 41 Wall Street, Room 1707, New York.

TELEPHONE, 5834 BROAD.

ESTABLISHED 1856.

HENRY MAURER & SON,

Manufacturers of

High Grade Firebrick, Blocks, Tiles,

ETC.,

Works: Maurer, N. J. Office: 420 E. 23d St N. Y. City

Bristol's Recording Pressure Gauges

(ALL RANGES).

Used the World Over.

Necessary Equipment

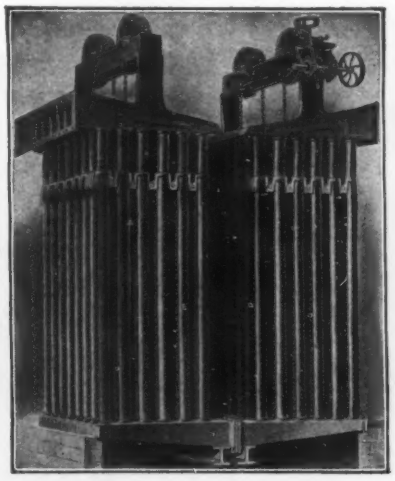
Write for Catalogue A.

For Every Gas Plant.

New York: 114 Liberty St.

Chicago: 753 Monadnock Bldg.

The Bristol Co., Waterbury, Conn., U S.A.



SAVE 15 PER CENT. OF THE COAL IN MAKING WATER GAS.

For every 1,000 cu. ft. of water gas 40 to 48 lbs. of anthracite are consumed in the generator, while 24 lbs. should theoretically be enough. The 40 per cent. to 50 per cent. excess is the margin of possible saving. By passing the hot, waste, stack-valve gases through a GREEN AIR HEATER you can cut down the bill for generator coal by at least 10 per cent. The air forced to the generator is passed through the tubes of the Air Heater and absorbs the waste heat from the stack-valve gases and returns it to the generator. The higher temperature in the generator, carburetter and superheater results, also, in a saving of oil, amounting to about one-fifth gallon per 1,000 cu. ft. of gas.

After the stack-valve gases have passed through the Green Air Heater they may be then passed through a GREEN FUEL ECONOMIZER to heat the boiler feed water, saving as much as 25 per cent. of the boiler fuel. The result is that a Green Air Heater and a Green Fuel Economizer will save from 50 per cent. to 60 per cent. of their first cost annually in a water gas plant. Write for circular "AG" and results of actual tests.

THE GREEN FUEL ECONOMIZER CO.,

MATTEAWAN, N. Y.

(Sole builders of the Green Fuel Economizer in the United States, and of Fans, Blowers and Exhausters.)

Lemon High Pressure Governor.

REYNOLDS' GAS REGULATOR COMPANY,

ANDERSON, IND., U. S. A.

We make all sizes for all classes of reduction,

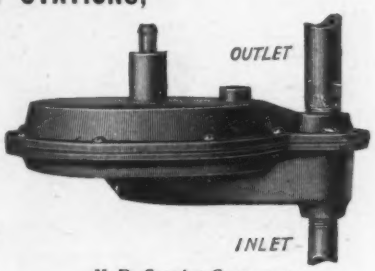
DOUBLE and SINGLE DISTRICT STATIONS,

And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

And Low Pressure Regulators, all of the Dry Diaphragm type.

Write for Catalog.



H. P. Service Governor.

LLOYD CONSTRUCTION COMPANY.
THE
LLOYD
INTENSIVE
SCRUBBER.
DETROIT-MICHIGAN

WHY DO GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS BUILT BY

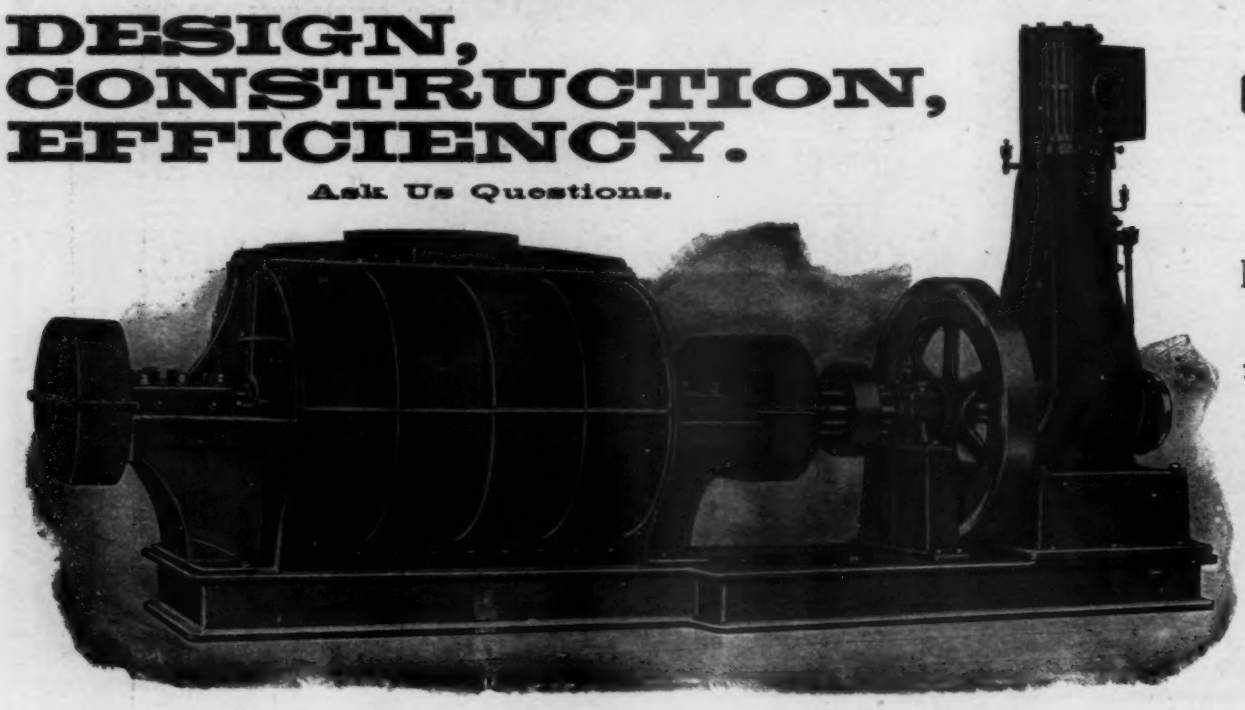
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

**DESIGN,
CONSTRUCTION,
EFFICIENCY.**

Ask Us Questions.



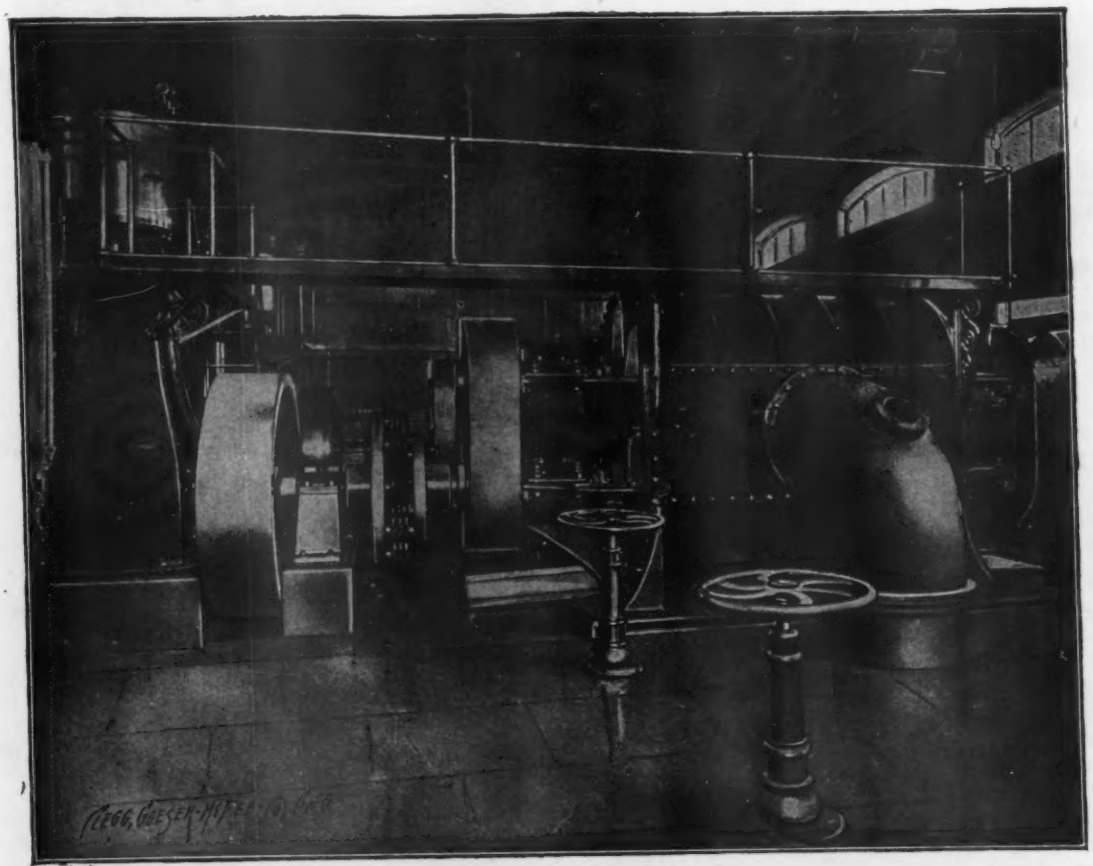
Home Office:
CONNERSVILLE, IND.

Eastern Sales Agent:
HORACE G. COOKE,
95 Liberty Street,
New York City.

Write us about our Improved Stuffing Boxes.

Something Entirely New.

ROOTS' GAS EXHAUSTERS.



Installation showing our latest improved machines, with flexible rope coupling, for large units.

SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

Shows up GOODS as they ARE

Have you Seen the
WHITE AND GOLD ENAMELED HUMPHREY ARC?
Handsome, Durable, High Power.
Sure to Bring in New Lighting Business.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

NEW YORK CITY:
46 West Broadway.

SAN FRANCISCO:
519 Eddy Street.

GEORGE ORMROD, Pres. & Treas. JOHN D. ORMROD, Supt.
J. G. EBERLEIN, Secretary.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

"THE MINER"

Globe Street and Boulevard Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

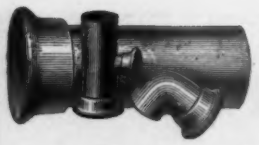
Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 170 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

PATRICK GOODMAN,
CONTRACTOR,
257-263 East 133d Street,

PIPE WORK A SPECIALTY.
WATER, GAS, DRAINAGE.

NEW YORK CITY.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

JUL 25 1904 9 47 AM

The Follett Time Stamp

Can be Used for so Many Purposes it would Take a Book to Name them. . . .

Address,
A. ANDERSON, JR.,
247 W. 31st St.,
NEW YORK.

POOLE ON FUELS.

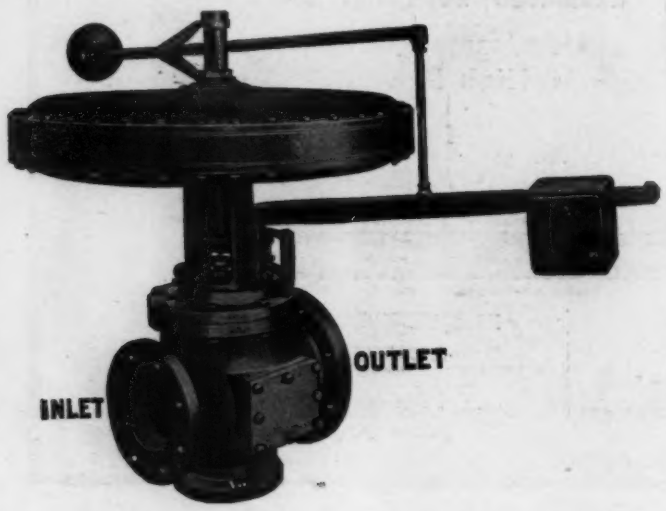
THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY

STANDARD REDUCTION FACTORS for GASES,
By Helon Brooks MacFarland, B.S., M.M.E.
Price, $1.50.
For Sale by
A. M. Callender & Co., 42 Pine St., New York City.



THE FULTON GAS PRESSURE GOVERNOR,

WITH AUTOMATIC SAFETY CUTOFF.

For Artificial or Natural Gas.
For District or Service Use.

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

SEND FOR LATEST CATALOG.

THE CHAPLIN-FULTON MFG. CO.,
28-30 PENN AVE., PITTSBURGH,

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

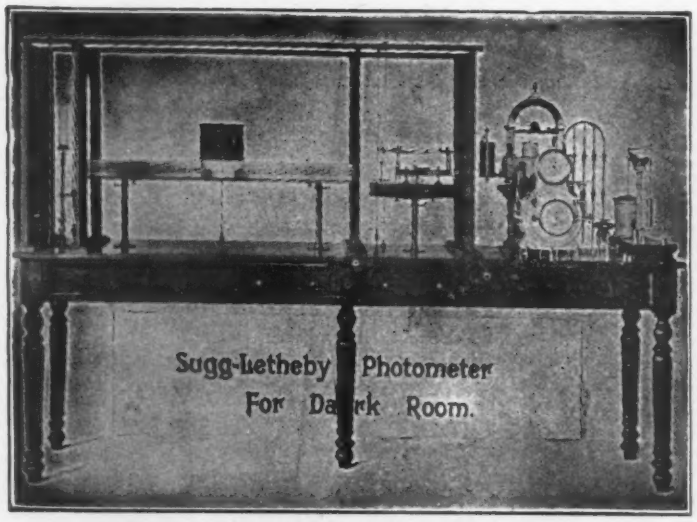
SEPTEMBER, 1907.

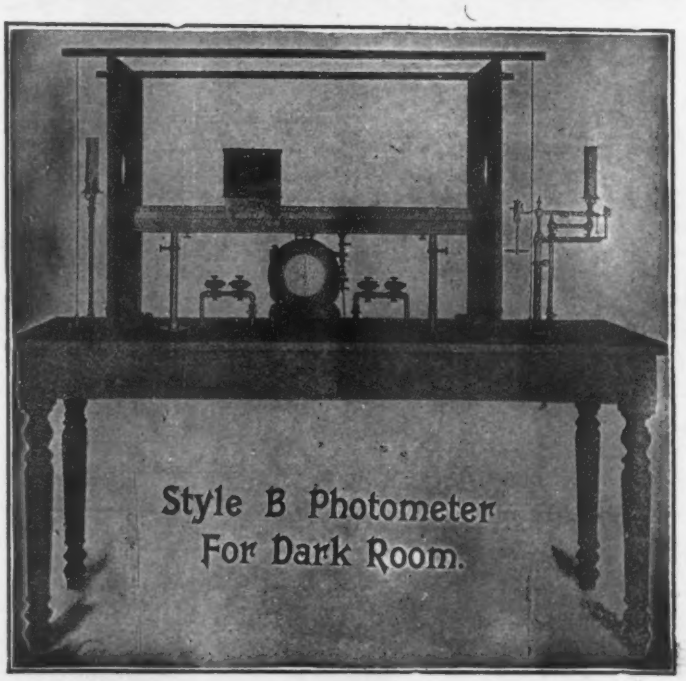
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.
Sun.	1	7.00 PM	1.20 AM
Mon.	2	7.00	2.10
Tue.	3	7.00	3.10
Wed.	4	7.00	4.30
Thu.	5	7.00	4.30
Fri.	6	7.00	4.30
Sat.	7	7.00 NM	4.30
Sun	8	6.50	4.40
Mon.	9	6 50	4.40
Tue.	10	6.50	4.40
Wed.	11	6 50	4.40
Thu.	12	8.10	4.40
Fri.	13	8.50	4.40
Sat.	14	9.40 FQ	4.40
Sun.	15	10.30	4.40
Mon.	16	11.30	4.40
Tue.	17	12.30 AM	4.40
Wed.	18	1.50	4.40
Thu.	19	3.00	4.40
Fri.	20	No L.	No L.
Sat.	21	No L FM	No L.
Sun.	22	No L.	No L.
Mon.	23	6.20 PM	8.20 PM
Tue.	24	6.20	8.50
Wed.	25	6.20	9.20
Thu.	26	6.20	10.00
Fri.	27	6.20	10.40
Sat.	28	6.20 LQ	11.20
Sun.	29	6.10	12.00
Mon	30	6.10	1.00 AM

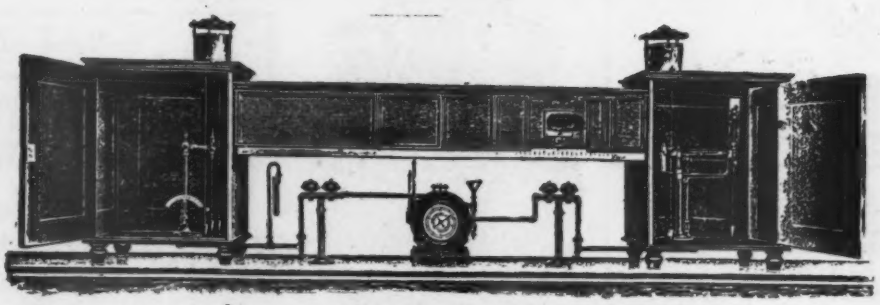
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1907.

Day of Week.	Table No. 2. New York City. All Night Lighting. Date.	Light.	Extinguish.
		P. M.	A. M.
Sun.	1	6.30	4.20
Mon.	2	6 30	4 20
Tue.	3	6 15	4.30
Wed.	4	6 15	4.30
Thu.	5	6 15	4.30
Fri.	6	6 15	4.30
Sat.	7	6 15	4 30
Sun.	8	6 15	4.30
Mon.	9	6 15	4.30
Tue.	10	6 05	4.40
Wed.	11	6 05	4.40
Thu.	12	6 05	4 40
Fri.	13	6 05	4 40
Sat.	14	6 05	4.40
Sun	15	6 05	4 40
Mon.	16	6 05	4 40
Tue.	17	5.55	4 50
Wed.	18	5.55	4 50
Thu.	19	5 55	4 50
Fri.	20	5 55	4 50
Sat.	21	5 55	4 50
Sun.	22	5.55	4 50
Mon.	23	5.55	4 50
Tue.	24	5.40	5.00
Wed.	25	5 40	5 00
Thu.	26	5.40	5 00
Fri.	27	5 40	5 00
Sat.	28	5 40	5 00
Sun.	29	5.40	5 00
Mon.	30	5.40	5.00

TOTAL HOURS DURING 1907.

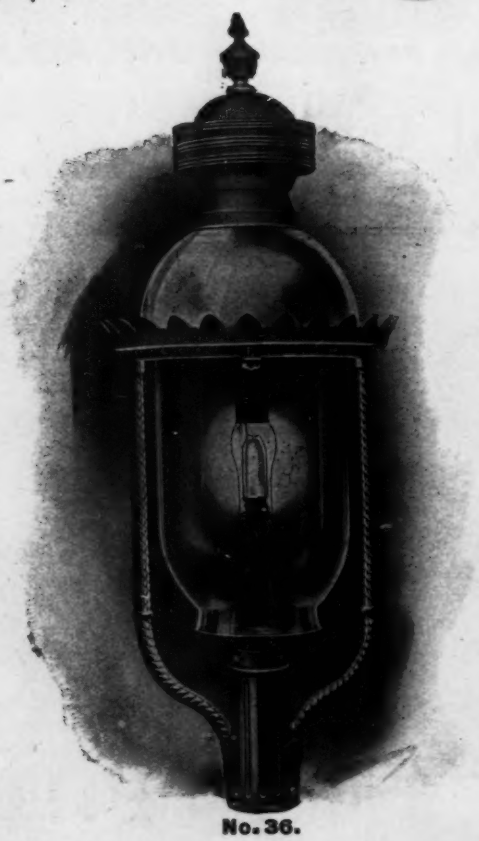
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

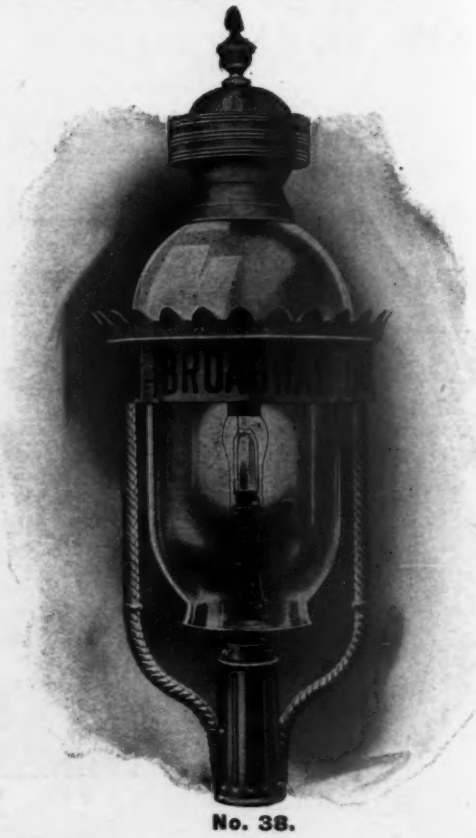
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

INVERTED REFLEX TRADE MARK GAS LIGHT

Succeeds and Excels the Electric Light at One-Quarter the Cost.

THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
Will Not Discolor Fixtures.
Will Not Discolor Ceilings.

THE MANTLE.

Best Welsbach Quality.
Extra Strong and Durable.
Highest Maintained Candle Power.
Rich Mellow Light.

THE GLASSWARE.

Highest Quality Imported.
Special Design Inner Cylinder (No. 317).
Protection from the Falling of Heated Particles.
Increases Candle Power.

Manufactured by

WELSBACH COMPANY.

FACTORIES:

Gloucester, N. J. Chicago, Ill.

Salesrooms in all leading cities of the United States.

WRITE FOR DISCOUNTS.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

LESSEES, OPERATORS AND BUILDERS

OF

GAS WORKS.

LARGEST BUILDERS OF

CARBURETTED WATER GAS PLANT IN THE WORLD.

SOLE BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.

1907 CONTRACTS.

PARTIAL LIST OF PLACES:

Newburgh, N. Y.
Helena, Mont.
Bridgeport, Conn. (3d contract).
Suffolk, Va.
Winsted, Conn. (2d contract).
Nashua, N. H.
Augusta, Me. (2d contract).
Everett, Mass.
Jenkintown, Pa. (2d contract).
Coney Island, N. Y.
Mexico, Mo.
Jacksonville, Fla.
Syracuse, N. Y. (2d contract).
Atlanta, Ga. (3d contract).
Holyoke, Mass.
Peoria, Ills.
Schnectady, N. Y. (2d contract).
Danbury, Conn.
Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
Sioux Falls, S. D. (3d contract).
Philadelphia, Pa.

TOTAL SETS INSTALLED TO JULY 1, 1907, ... 34
TOTAL SETS TO DATE, ... 668
TOTAL DAILY CAPACITY, ... 541,655,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

ESTABLISHED 1868.

L. N. RANCKE, Vice-Pres. & Mgr. F. SCHIAFFINO, Sec'y & Treas.

BALTIMORE RETORT & FIREBRICK CO.

BALTIMORE, MD.,

Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

WALDO BROS., 102 MILK ST., BOSTON, MASS.,
Agents for New England States.

LARGE FACILITIES—Correspondence Solicited.
RAIL and WATER CONNECTIONS to ALL POINTS.

L. C. HAMLINK, PRES. AUGUST COURT, SECY.

GAS BENCH CONSTRUCTION CO.

LINMAR BUILDING. ST. LOUIS, MO.

**COAL GAS BENCHES.
BENCH FILLINGS.
WATER GAS
LININGS.**

"CHRISTY" REFRACTORIES USED IN "BETTER BENCHES"

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

Newbigging's Handbook for Gas Engineers and Managers. Price, $6.50. For Sale by A. M. Callender & Co., 42 Pine St., N. Y. City.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada, Detroit, Seattle, Rochester and St. Louis.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich., and Cincinnati, Ohio. These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

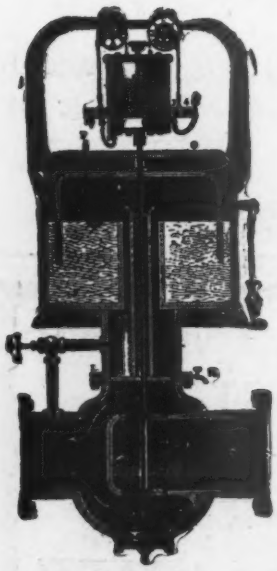
Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins. Coke Screening and Measuring Plants a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



Design, Construction and Extension of

COAL OR WATER GAS PLANTS,

Automatic, Balance, High Pressure and Service Governors.

Roots Improved Gas Exhausters,

Iron Sponge, Purifying Material, for Gas Purification, Jones Jet Photometers, Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM.

Reinforced Concrete Construction for all Purposes.

Wide Experience in High Pressure Installation and Extension.

GAS SPECIALTIES.

395 Broadway, New York.

295 West 22d Street, Chicago, Ills.

ALCOHOL, Its Manufacture from Farm Products and De-Naturing,

By F. B. WRIGHT.

A NEW AMERICAN BOOK.

CONTENTS.

Chapter 1. Alcohol, its various forms and sources.
" 2. Mashing, cooling and fermentation in general.
" 3. Distillation, simple forms of stills, the production of Alcohol from wine.
" 4. Malting.
" 5. Alcohol from Potatoes, mashing, fermentation, distillations, Continuous stills.
Chapter 6. Alcohol from Grain.
" 7. Alcohol from Beets.
" 8. Alcohol from Sorghum and Molasses.
" 9. De-natured Alcohol and its Commercial uses.
" 10. Alcoholometry. Index.

Fully Illustrated with Original Drawings of Necessary Apparatus.

PRICE, $1. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

1907 DIRECTORY 1907

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

OCEAN MINE YOUGHIOGHENY GAS COAL,
OLD KENTUCKY SHALE AND O. K. BOGHEAD.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

NAPHTHALENE SOLVENT.

Cheap and Efficient.

For Use in Works, Mains and Service Pipes. Shipped in 100-gallon Drums.

Semet-Solvay Co.,
Syracuse, N. Y.

JEFFREY COAL AND ASH HANDLING SYSTEMS

FOR POWER PLANTS

Insure a Saving of 50 to 75 per ct.

Views of the Globe-Wernicke Co.'s power house, equipped with Jeffrey Machinery. An apron carrier takes coal from crusher to feeding hopper which loads the swivel buckets.

Bulletins B and C mailed free with Catalogs on ELEVATING, CONVEYING, CRUSHING, SCREENING, DRILLING, MINING MACHINERY.

The JEFFREY MANUFACTURING CO.,
COLUMBUS, OHIO, U. S. A.

New York. Chicago. St. Louis. Pittsburgh. Boston. Denver. Knoxville. Philadelphia. Montreal, Canada. Charleston, W. Va.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Secretary and Treasurer.

Works. LOCKPORT STATION, PA.

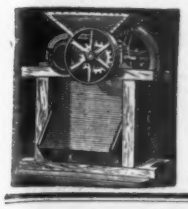
JAMES GARDNER, JR., CO.,

Address all communications to JAMES GARDNER, JR., CO., Bolivar, Pa.

Successor to **WILLIAM GARDNER & SON.**

Fire Clay Goods for Gas Works.

GAS ANALYST'S MANUAL. By JAQUES ABADY. Price, $6.50. For Sale by A. M. Callender & Co., 42 Pine St., N. Y. City.



KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,
Rooms 201 & 202. DETROIT, MICH.

EDMUND H. McCULLOUGH, President. H. C. ADAMS, Vice-President. CHAS. F. GODSHALL, Treasurer. HENRY WHARTON, Secretary. C. B. NICHOLS, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

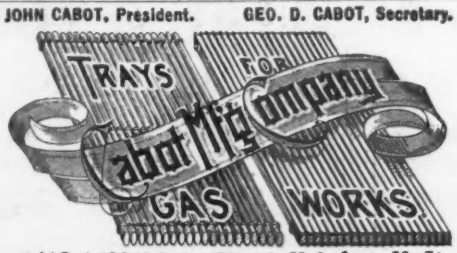
POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

JOHN CABOT, President. GEO. D. CABOT, Secretary.



1412-1428 Adams Street, Hoboken, N. J.

PURIFIER AND SCRUBBER TRAYS
OF ALL KINDS.

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Oxide.

We also Supply the Cheapest and Strongest

Reversible Bolted Trays.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.

Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by

A. M. Callender & Co., 42 Pine St., New York City.

GAS ANALYST'S MANUAL,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.

For Sale by **A. M. CALLENDER & Co., 42 Pine St., New York City.**

FIELD'S ANALYSIS

For the Year 1906.

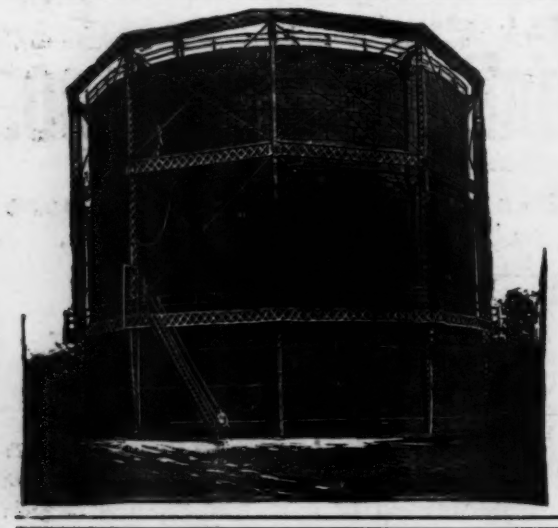
An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 38th Year of Publication.

COMPILED AND ARRANGED BY **JOHN W. FIELD,**

Secretary and General Manager of The Gas Light and Coke Company, London.

PRICE, $5. FOR SALE BY

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.



DAVIS & FARNUM MFG. CO.,
Principal Office and Works, Waltham, Mass.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

H. M. BYLLESBY & COMPANY
(INCORPORATED).

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE
COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

EXAMINATIONS AND REPORTS.

AMERICAN TRUST BUILDING,
CHICAGO.

Oklahoma City, Okla. Mobile, Ala. San Diego, Cal.

PRACTICAL GAS CONSTRUCTION COMPANY,
Office and Works at North Chicago, Ill.

CONSTRUCTION GAS ENGINEERS.

Standard Water Gas Apparatus. Practical Oil Gas Works and Machinery. Steel Tank and Cistern Holders--quick delivery up to 50,000 cu. ft. capacity. Dry Seal Steel Purifying Boxes.

OIL STORAGE, COMPRESSED GAS STORAGE AND BAFFLE TANKS.

New Gas Works installed complete, including all Generating Apparatus, Machinery, Buildings, Storage Tanks, Holders and STREET MAINS FOR HIGH OR LOW PRESSURE DISTRIBUTION SYSTEMS.

ENGINEERING SERVICES AND REPORTS BY ARRANGEMENT.

PLANS AND SPECIFICATIONS ON REQUEST.

QUINTARD IRON WORKS,
N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,
CONSULTING ENGINEERS.

BANK OF COMMERCE BLDG.,
31 Nassau Street,
New York.

38 VICTORIA STREET,
London, S. W.,
England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.

PROPERTIES PURCHASED.

Bartlett, Hayward & Company,

Baltimore, Md. 100 Broadway, New York.

GASHOLDERS,

Coal and Water Gas Plants.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS
AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, FORT WAYNE, IND.

R. D. WOOD & CO.,

400 CHESTNUT STREET, PHILADELPHIA,

—BUILDERS OF—

Gas Power Plants with Producers,

The best Producers for either Bituminous, Anthracite Coal or Lignite. Less labor required and less waste than in any other Producer. Send for Pamphlet. : : : :

CAST IRON PIPE.

HYDRAULIC TOOLS. HYDRAULIC OPERATING VALVES.

Double Gate Valves.

A LARGE STOCK ON HAND READY FOR PROMPT SHIPMENT.

These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.	8 Inches.	10 Inches.	12 Inches.	16 Inches.	20 Inches.	24 Inches	30 Inches.	36 Inches.
Diameter of flanges.....	13 inches.	16 inches.	18 inches	22½ inches.	27 inches.	3 inches.	3 1/4 inches	44 inches.
Face to face of flange...	12 inches.	12 inches.	12 inches	14 inches.	17 inches.	20 inches.	21 inches.	23½ inches.

For price and other information, apply to

THE CONTINENTAL IRON WORKS,

NEW YORK (BOROUGH OF BROOKLYN).

P. O. STATION G.

FRANK D. MOSES,

Telephone, 1503-D TRENTON, N. J., Telephone, 1503-D

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. PITTSBURGH, PA.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,

1200 Bank for Savings Bldg., Pittsburgh, Pa.

PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THE STACEY MANUFACTURING COMPANY,

GAS ENGINEERS AND BUILDERS,

GASHOLDERS.

MAIN OFFICE AND WORKS, - - Station P, Cincinnati, Ohio.
WESTERN OFFICE, - - - - - 519 Eddy St., San Francisco, Cal.

RITER-CONLEY COMPANY,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburgh, Pa. EASTERN OFFICE: 111 Broadway, New York City.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

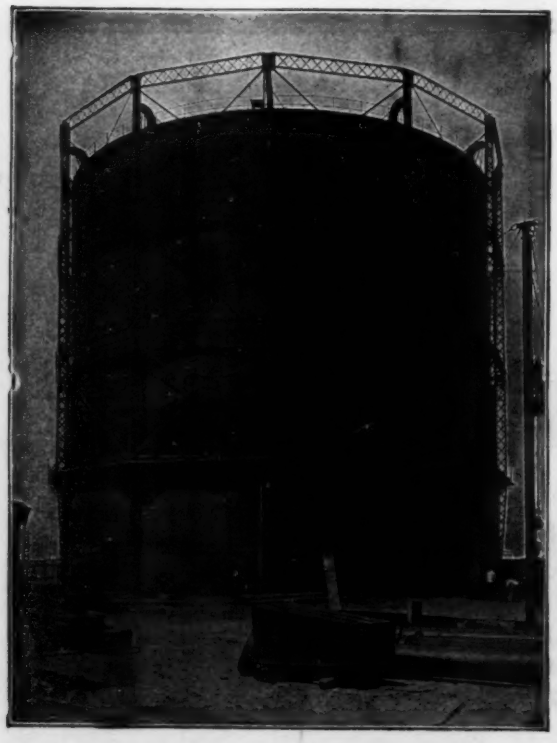
FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Newbigging's Handbook for Gas Engineers and Managers.

PRICE, $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



Deily & Fowler,

39 Laurel Street, Philadelphia, Pa.

(ESTABLISHED 1842),

BUILDERS OF

GASHOLDERS,

Single-Lift or Telescopic,

With or Without Steel Tanks.

Oil Storage Tanks, Water Tanks, Etc.

ESTIMATES CHEERFULLY FURNISHED.

CORRESPONDENCE SOLICITED.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for

Complete Works.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

FIELD'S ANALYSIS FOR THE YEAR 1906.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland; being the 38th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by A. M. CALLENDER & CO., 42 Pine St., New York City.

SELF-INSTRUCTION

For Students in Gas Manufacture.

ELEMENTARY, ADVANCED AND CONSTRUCTIONAL.

Three Volumes. Price, $1.50 each. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

BEFORE YOU DECIDE

To place your contract for meters send for catalogue and prices of

WESTINGHOUSE DRY GAS METERS

Ordinary Capacity
Large Capacity
Prepayment

A careful examination and thorough test in actual service will demonstrate their superiority.

PITTSBURG METER CO.

East Pittsburg, Pa.

70 PER CENT.

Of Our Output is

PREPAYMENT GAS METERS.

We have fitted up over 16,000 Idle, Regular Meters with our

PREPAYMENT ATTACHMENT.

Can be attached to any make of meter.

NATHANIEL TUFTS METER COMPANY, 455 COMMERCIAL ST., BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. **CHICAGO, 1307 Railway Exchange.**

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

WHEN YOU SEND REPAIRS TO US

They can be changed to Prepayment, Prepayment and Beal Straight-reading, or Beal Straight-reading only. Good job. Good time. Good people. Write us.

KEYSTONE METER CO., Royersford, Pa.

EXTRA HEAVY TIN GAS METERS,

WITH

REINFORCED CONSTRUCTION, LARGER CAPACITY,

AND

THOROUGHLY SEASONED DIAPHRAGMS.

MEANS LOW MAINTENANCE COST. FIRST COST NO MORE.

PREPAYMENT METERS.

NEW YORK PREPAYMENT ATTACHMENT.

PRICES ON REQUEST.

NEW YORK IMPROVED METER CO., *306-310 East 47th St., New York City.*

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers,
Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

The "Gas World" Analyses of Accounts of Gas Undertakings,

For 1905-1906,

Showing at a glance the Accounts of 113 Coal and Water Gas Companies, Itemized under

Coal Carbonized, Gas Made and Sold, Yield of Residuals, Public Lamps, Mileage of Mains, Consumers, Price of Gas, Illuminating Power, Financial Results, Revenue.

Manufacturing Charges, Rates and Taxes, Distribution Charges, Management Charges, Bad Debts, Capital Paid Up, Capital per Ton and per Thousand, Reserve Funds, etc.

EVERY GAS ENGINEER AND MANAGER SHOULD HAVE A COPY OF THIS INVALUABLE AND UP-TO DATE WORK.

Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,
PHILADELPHIA.

539 West 47th Street,
NEW YORK.

Jefferson and Monroe Streets,
CHICAGO.

GAS METERS,

Station Meters and Apparatus of Every Description.

REPAIRING CAREFULLY DONE.

THE POSITIVE PREPAYMENT METER.

500,000 OF THESE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES, AND THE DEMAND IS STEADILY INCREASING.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

SEND FOR OUR CATALOGUE AND OUR PREPAYMENT BOOKLET.